PAGE'S WEEKLY.—November 24, 1905. Thin Paper Copy for Circulation Abroad.

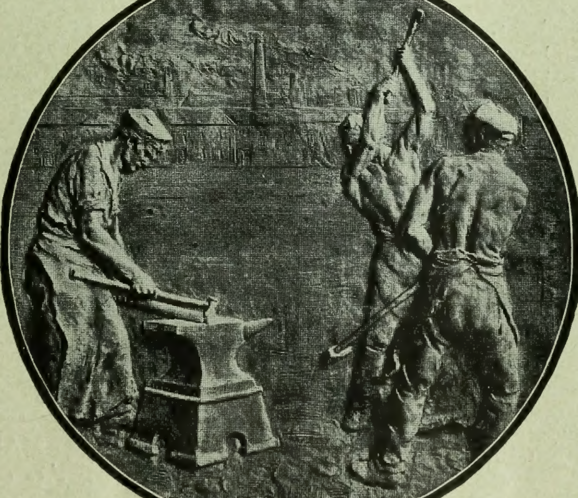
NO. 63. VOL. 7.

SIXPENCE.
(REGISTERED AS A NEWSPAPER.)

FRIDAY,
NOVEMBER 24, 190

PAGE'S WEEKLY

BRARY
2 2 1905
UNI SITY OF TORONTO



ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

EDITORIAL & PUBLISHING OFFICES, CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

FRANCE, Paris : 22, Rue de la Banque.
GERMANY, Berlin : 13, Unter den Linden.
RUSSIA, St. Petersburg : 14, Nevsky Prospect.
ITALY, Rome : 307 Corso.
AUSTRIA, Vienna : Kärntnerstrasse, nr. 30.

INDIA, Calcutta : Thacker, Spink & Co.
 ,, Bombay : Thacker & Co., Ltd.
SOUTH AFRICA, Cape Town : Gordon & Gotch.
JAPAN, Yokohama : Kelly & Walsh, Ltd.
NEW ZEALAND : Gordon & Gotch, Ltd.

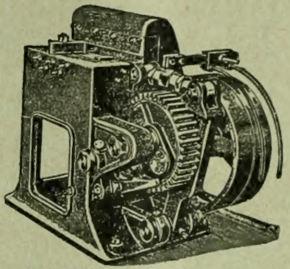
CANADA : Montreal News Company.
UNITED STATES, New York : International News Co.
 ,, Chicago : Subscription News Co.
AUSTRALIA, Melbourne : Gordon & Gotch.
STRAITS SETTLEMENTS, Singapore : Kelly & Walsh, L

C. W. Hasenclever Söhne
DÜSSELDORF.

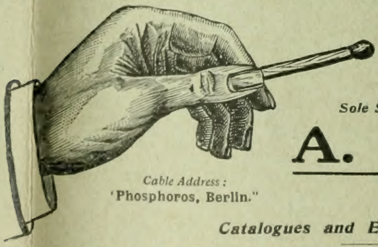
Special Machinery

FOR MAKING

**Bolts, Nuts, Rivets,
Insulator Brackets,
Horse-Shoes,
Horse-Shoe Nails,
Calkins, and
Similar Forgings.**



ROLLING MACHINE FOR IRON SCREW THREAD.



Cable Address:
"Phosphoros, Berlin."

Match & Match Box
MACHINERY.

Sole Speciality since establishment in 1855 of

A. ROLLER, Engineer,

BERLIN N.20, GERMANY.

Catalogues and Estimates for Complete Plants Free on Application.

REFERENCES TO MATCH MANUFACTURERS ALL OVER THE WORLD.

PATENT PAPER PINIONS
FOR NOISELESS MOTOR DRIVES.

MACHINE-CUT GEARS
OF ALL DESCRIPTIONS.

THE REID GEAR CO.,
Linwood, PAISLEY.

IN EVERY SIZE FOR
HAND OR POWER
USE

HACK SAW BLADES

CHARLES BAYNES

The Sole Product of a Factory.

Best English Steel throughout

WORKS:
KNUZDEN BROOK
BLACKBURN

PAGE'S WEEKLY Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,

Consulting and Organising Engineer for Water Works and Industrial Undertakings,

19, OLD QUEEN ST., WESTMINSTER, S.W.

Telephone No.: 5754 Bank. Write for particulars.

A. MOUNT-HAES,

M.I.Mech.E., M.I.M.E.,

Consulting and Mining Engineer for Ore Dressing Plants of All Classes.

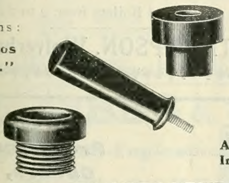
II, IRONMONGER LANE, LONDON. E.C.

Tel. Address: "DRESSINGS, LONDON." Telephone No.: 272 Central.

INSULATORS

Telegrams: **"Ebonestos London."**

Telephone: 1422 Holborn.



SUITABLE FOR BUSHINGS, NIPPLES, SWITCH HANDLES.

And other small Insulator Fittings.

Patentees and Manufacturers:

EBONESTOS MANUFACTURING CO.,

22, Rosoman Street, Clerkenwell, LONDON, E.C.

Second Edition, Revised. Price 7s. 6d.

DEPRECIATION OF FACTORIES, Mines, and Industrial Undertakings, and their Valuation. With Tables and Examples.

By EWING MATHESON, M.Inst.C.E.

The Principles which should guide the Writing off for wear and tear, Obsolete plant; Terminable or wasting properties; Effect on ncome-tax; Value defined as for Compulsory purchase; Going concern or dismantled; Rateable value, rental value.

"A successful attempt to systematise existing information and to make it possible to arrive at uniformity and accuracy in making up balance sheets for valuations. The work is unique of its kind."—*The Engineer.*

E. & F. N. SPON, 125, Strand, London.

JOSEPH BOOTH BROS., LTD.,
RODLEY, LEEDS.

See next week.

LIFTING MACHINERY.

THOS. W. WARD,
ALBION WORKS,
SHEFFIELD.

See Page 17.

MACHINE TOOLS.

THE SHANNON, LTD.,
Ropemaker St., London, E.C.

See Page 69.

OFFICE APPLIANCES.

Have you seen our Advertisement on page ~~69~~ 49 ? A glance at it may save you £500 per annum.—ED. BENNIS & CO., Ltd., BOLTON.

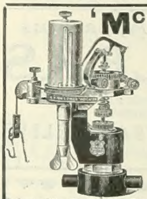
PAGE & ROWLINGSON,

Chartered Patent Agents.

Handbook of Information Free.

28, NEW BRIDGE STREET, LONDON, E.C.,
And 14, St. Ann's Square, Manchester.

'McINNES-DOBBIE' INDICATORS.



In Two types: External and Enclosed Pressure Springs.

Each made in several forms and sizes to suit all speeds and pressures.

Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.

DOBBIE, McINNES, LIMITED,
45, BOTHWELL ST., GLASGOW.

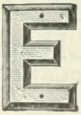
Adopted by the British, French, and Japanese Admiralties.

Bogie Locomotives for Short Curves. A large number of these Engines have been built to NARROW and to NORMAL GAUGE.—For full particulars, and for Licences, &c., address the HAGAN'S LOCOMOTIVE WORKS, ERFURT, GERMANY.

Melville and Macalpine, Consulting Engineers and NAVAL ARCHITECTS,
615, WALNUT STREET, PHILADELPHIA, PA., U.S.A.

Rear-Admiral GEORGE W. MELVILLE, Ex-Engineer-in-Chief of the United States Navy, and JOHN H. MACALPINE, having a very extensive acquaintance in the best engineering circles in the United States, Britain, and the Continent of Europe, especially SOLICIT INTERNATIONAL BUSINESS.

MOULDERS' LETTERS AND FIGURES.

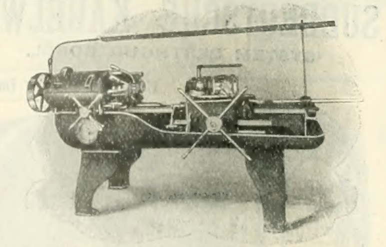


Marks, Name Stamps, Branding Irons, Sets of Letter and Figure Punches, Brass Labels and Time Checks, Embossing Presses, Dies and Seals, Brass Name Plates, Stencil Plates, India Rubber Stamps.

EDWARD PRYOR & SON,
68, West Street, SHEFFIELD.

HARTNESS

FLAT TURRET LATHE



The only Turret Lathe with Cross-Sliding Head.

JONES & LAMSON MACHINE CO.,
"JUBILEE BUILDINGS,"
97, Queen Victoria Street, LONDON.

PAGE'S WEEKLY Miscellaneous

I WANT A POSITION

as your Advertisement Manager.

SALARY REQUIRED 5/- PER ANNUM.

I will give my services FREE for the first month, if you will send a penny stamp to defray my travelling expenses.

The BRITISH ADVERTISER,
Queen Anne's Chambers, WESTMIMSTER, S.W

HARTLEY & SUGDEN, LIMITED, HALIFAX. TRADE MARK H & S Hx

Heating Apparatus

BOILERS

Wrot Welded Iron and Cast Iron Sectional

VERTICAL STEAM BOILERS

Apply for Catalogue.

"CAMPBELL"

GAS ENGINES & SUCTION PLANTS, OIL ENGINES & PUMPS.

SOLE MAKERS—

THE CAMPBELL GAS ENGINE CO.,

Halifax, England. *Limited,*

London Office—
114, Tooley Street, S.E.

Glasgow Office—
104, Bath Street.

J. FREDK. MELLING,

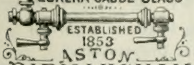
14, Park Row, LEEDS, ENGLAND.

Iron & Steel Bars, Plates, Sheets, Girders, Channels, Angles, Rails, Blooms, Billets, & Slabs.

Write for Section Lists and Prices.

Telegrams: "LEGATION, LEEDS."

J. TOMEY & SON'S
EUREKA GAUGE GLASS



ASTON
BIRMINGHAM.

A NEW GAUGE GLASS.

Samples, Lists, and Testimonials on application

"S.H.P."

Tested to 350 lb. Steam Pressure.

For High Pressure Boilers.

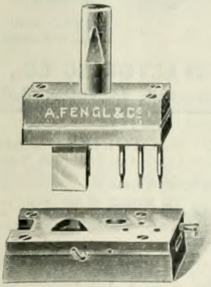
NEW BOILERS

READY FOR PROMPT DELIVERY.

		Size.	Working Pressure.
One	Thompson Boiler,	30 ft. by 8 ft. 6 in.	for 160 lb.
Three	,, ,,	30 ft. ,, 8 ft. 6 in.	,, 120 lb.
One	,, ,,	30 ft. ,, 8 ft. 6 in.	,, 100 lb.
Three	,, ,,	30 ft. ,, 8 ft.	,, 120 lb.
Six	,, ,,	30 ft. ,, 8 ft.	,, 100 lb.
One	,, ,,	28 ft. ,, 7 ft.	,, 140 lb.
One	Cornish ,,	20 ft. ,, 5 ft.	,, 100 lb

All sizes of Vertical Boilers from 2 to 20 n.h.p.

JOHN THOMPSON, Wolverhampton.



DO YOU WANT ANY

Press Tools, Jigs, Cutters, Rimers, Gauges?

If so, send your requirements, and

A. FENGL & CO., ALTRINCHAM,

will submit design and price.

Inventors' Models Worked Out and Manufactured.

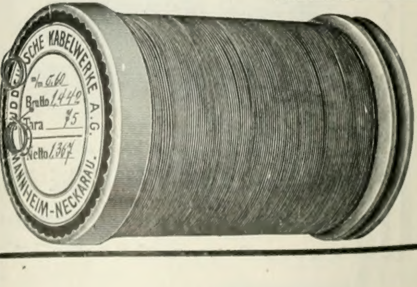
STAMPINGS TO THE TRADE.

Telegrams: "Fengl, Altrincham."

SÜDDEUTSCHE KABELWERKE A.-G., Mannheim, GERMANY.

(SYSTEM BERTHOUD BOREL.)

Contractors to the Imperial German Postal Authorities.



Silk-Covered Copper Wires

TELEPHONE CABLES.
With Paper and Air Insulation.

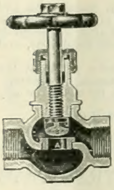
LEAD-COVERED CABLES
For all Tensions up to 40,000 volts.

PAGE'S WEEKLY. Miscellaneous

"ZECO" Brand.

Blue Planished and Glazed Steel Sheets for Lagging and Covering generally.

ZEITZ & Co., 21, Lime St., London, E.C.



The "SHAW" Patent Steam Valves . .

With Renewable Seats, Interchangeable Concentric Valve, Compound Packing to Spindle, Special Metal, and High-Class Workmanship.

The "SHAW" Patent Parallel Slide Valve is the Acme of Simplicity and Durability.

Try Them ! Sent on Approval.

☞ *Write for particulars of these and other Specialities for High Pressure Steam.*

JOSEPH SHAW, B Dept., Albert Works, HUDDERSFIELD

JOHN GIBBS & SON

Ventilating Engineers,

80, JUKE STREET, LIVERPOOL.

Say Advertising does not pay.

SEE OUR ILLUSTRATED ADVERTISEMENT NEXT WEEK.

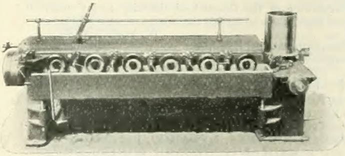
Refuse Destructors.

Write for particulars to :—

HEENAN & FROUDE, LIMITED,

4, Chapel Walks, MANCHESTER.

Works: MANCHESTER and WORCESTER.



ED. BRAND, 35, Shakespeare St. MANCHESTER.

INQUIRIES SOLICITED.

Telegraphic Address : "Filieres, Manchester."

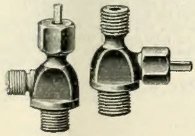
Patent Continuous Wire-Drawing Machine.

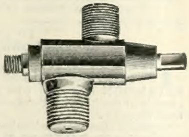
Modern Wire-Working Machinery,
Complete Wire-Drawing Plants, Draw Benches, Galvanising, Tinning, and Annealing Plants.

WEST PASCAGOULA CREOSOTING WORKS,

WEST PASCAGOULA, MISS., U.S.A.

Situated on Pascagoula Bay and on the line of the Louisville and Nashville Railroad. These works have been in operation for more than twenty-six years. ORDERS for Creosoted Piles, Telegraph Poles, Cross Arms, Electric Conduits, Paving Blocks, Sawed Tiles, and Timber PROMPTLY EXECUTED. New cylinders, 115 ft. long. Capacity, one million feet per month. A.B.C. Code used. Cable address: Pierre, West Pascagoula, Miss.—Address JNO. B. LINDSEY, Superintendent.





The
Scotch & Irish Oxygen Co., Ltd.,
ROSEHILL WORKS, GLASGOW.

Valves for Gas Bottles, Refrigerating Plant, etc., in Bronze, Steel, and Aluminium.

Reducing Valves, Keys, and all Fittings for Compressed Gases.

Hack Saw Blades

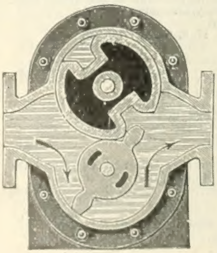
"H. G. T."

(High Grade Throughout.)

Proved BEST by Independent TEST.

Lists and Samples Free.

BEANLAND, PERKIN & Co.,
2 to 8, Neville Street, LEEDS.



SECTION OF "DRUM" PUMP.

THE . . .
"DRUM"
PUMP.
JOHNSON'S PATENTS.

Write for Catalogue 63.

POSITIVE ACTION.
NO VALVES.
HIGH EFFICIENCY.

DRUM ENGINEERING CO.,
33, Brook St.,
BRADFORD.

PAGE'S WEEKLY Contracts

CONTRACTS.

BRISTOL DOCKS.—NEW DOCK WORKS,

AVONMOUTH.

FENDER CHAINS.

The Docks Committee of the City and County of Bristol are prepared to receive TENDERS for the **CONSTRUCTION, DELIVERY, ERECTING IN PLACE, and MAINTENANCE** for Twelve Months after Erection of **FENDER CHAINS** for the Entrance Lock of the Royal Edward Dock now in course of construction at Avonmouth, in the Port of Bristol.

The contract includes Hydraulic Winding Engines, Relieving Gear, Chains, Capstans, and all details in connection therewith.

On and after November 21st, 1905, copies of the Specification, Schedule of Quantities, Form of Tender, Form of Contract, and Copies of Contract Drawings, can be obtained from the undersigned on production of a receipt from the Secretary of the Docks Committee, showing that a deposit of £5 has been paid in to his office, 19, Queen Square, Bristol.

The deposit will be returned to *bona fide* Tenderers hereafter.

Tenders must be enclosed in a sealed envelope, endorsed "Tender for Fender Chains," and addressed to the Secretary of the Docks Committee, Docks Office, 19, Queen Square, Bristol, and must be delivered to him accompanied by the necessary documents before ten a.m. on Thursday, December 7th, 1905.

The Docks Committee of the Council of the City and County of Bristol do not bind themselves to accept the lowest or any Tender.

W. W. SQUIRE,
Engineer.

Engineer's Office, Cumberland Road,
Bristol, November 13th, 1905.

POPLAR UNION.—The Guardians of the Poor of the Poplar Union are prepared to receive **TENDERS** for the Supply and Erection of the following **PLANT** at the Children's Homes and Schools now in course of erection at Hutton, Essex :—

Section X. STEAM ENGINES, DYNAMOS, PIPEWORK, &c.
" Y. Part 1. MAIN SWITCHBOARD, WIRING, MOTORS, &c.
" " Part 2. FIRE ALARMS, TELEPHONES, and ELECTRIC BELLS.

Persons desirous of tendering may obtain the General Conditions, Specifications, and Schedules, and inspect Plans at the Offices of the Consulting Engineer Mr. ALBION T. SNELL, M.Inst.C.E., Suffolk House, 5, Laurence Pountney Hill, Cannon Street, E.C., between the hours of 10 and 4, on and after November 21st, upon depositing in notes or gold the sum of £10 for Section X, and £20 for Section Y, which sum will be returned upon receipt of *bona fide* Tenders.

Contractors will be required to pay all workmen employed the trade union rate of wages, and to observe the hours of labour current in the district.

Sealed Tenders upon the forms supplied, addressed to me, are to be delivered at these offices before six o'clock p.m. on Wednesday, December 13th, 1905, when they will be opened at a meeting of the Guardians.

The Guardians do not bind themselves to accept the lowest or any Tender.

G. HERBERT LOUGH,
Clerk to the Guardians.

Guardian's Offices, 45, Upper North Street,
Poplar, E., November 15th, 1905.

TO ENGINEERS.

WATERWORKS PUMPING PLANT.

THE WIDNES CORPORATION INVITE TENDERS for the SUPPLY and ERECTION of a TRIPLE-EXPANSION ENGINE, with 20-in. deep Borehole and Force Pumps capable of discharging three million gallons per diem against a total head of 500 ft.

Copies of General Specification, Conditions, and Plans may be had on application to ISAAC CARR, M.Inst.C.E., Widnes, on payment of Two Guineas, which will be returned on receipt of a *bona fide* Tender.

Tenders, addressed to the Chairman of the Water Committee, and endorsed "Pumping Engine," must be delivered at the Town Hall, Widnes, on or before noon on Tuesday, December 5th, 1905.

By order,
H. S. OPPENHEIM,
Town Clerk.

Widnes, November 1st, 1905.

GREAT NORTHERN RAILWAY COMPANY (IRELAND).

The Directors are prepared to receive TENDERS for the SUPPLY of SIX STEAM RAIL MOTOR CARS, in accordance with the Company's Drawings and Specification, copies of which can be obtained on application to the undersigned on payment of One Guinea (not returnable) per set.

Tenders, marked "Tender for Motor Cars," must be lodged with the Secretary not later than 10 a.m. on Monday, December 4th, 1905.

The Directors do not bind themselves to accept the lowest or any Tender.

T. MORRISON,
Secretary.

Secretary's Office, Amiens Street Terminus, Dublin,
November 8th, 1905.

THE RURAL DISTRICT COUNCIL OF CHELMSFORD.

INGATESTONE WATERWORKS. PUMPING MACHINERY.

The above-named Council invite **TENDERS** for **MAKING, DELIVERING, SETTING TO WORK, and MAINTAINING** in good order for six months, at their Waterworks Pumping Station, Ingatestone, Essex, of :—

One **HORIZONTAL GAS ENGINE**, with Suction Gas-Producer Plant.
One Two-throw **DEEP-WELL PUMP**, of 5,000 gallons per hour capacity.
Two Sets of Treble Ram **FORCE PUMPS**, each of 5,000 gallons per hour capacity.

Also for Taking Out and Altering a Bore Hole Pump and Removing and Refixing an Oil Engine, together with all necessary Gearing, Pipes, Valves, and Fittings.

Drawings, and a copy of the General Conditions, Specification, and Form of Tender, may be obtained at the Office of the Engineer on deposit of £1 (cheque only), which will be returned after the receipt of a *bona fide* Tender, together with the Drawings, Conditions, and Specification.

Tenders to reach the undersigned not later than noon on Friday, the 1st day of December, 1905, endorsed "Tender for Pumping Machinery."

The Council do not bind themselves to accept the lowest or any Tender.

JAMES DEWHIRST, A.M.I.M.E.,
Engineer.

Avenue Chambers, Chelmsford,
November 8th, 1905.

THE DUBLIN UNITED TRAMWAYS COMPANY (1896), LIMITED.

The Company is prepared to receive Tenders for the Supply of **GENERAL STORES**, including Car Fittings, Iron, Steel, Castings, Oils, Paints, Glass, Brushes, Ironmongery, Harness Materials, Electrical Supplies, Timber, &c., for the year ending December 31st, 1906.

Forms of Tender (price 2s. each), Conditions, and all information can be obtained, and patterns seen, at the Secretary's Office, 9, Upper Sackville Street, Dublin, from 9th to 22nd November instant.

Tenders, sealed and marked on the outside "Tenders for Stores," and addressed to the Chairman, to be lodged with me on or before 27th November instant.

By order,
R. S. TRESILIAN, Secretary.

9, Upper Sackville Street, Dublin, November 7th, 1905.

THE SOUTH INDIAN RAILWAY COMPANY, LIMITED, is prepared to receive **TENDERS** for the SUPPLY of—

1. ROLLING STOCK—200 Steel Covered Goods Wagons.
2. WHEELS and AXLES—400 pairs.
3. LAMINATED BEARING SPRINGS—No. 800.
4. ROOFING, &c.—about 150 tons.

Specifications and Forms of Tender may be obtained at the Company's Offices

Tenders, addressed to the Company, marked "Tender for Rolling Stock," or as the case may be, must be left with the undersigned not later than 12 o'clock noon of Tuesday, the 28th of November, 1905.

The Company is not bound to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 20s. for each copy of Specification (1) and of 10s. for each copy of the remainder.

Copies of the Drawings may be obtained at the office of Sir GEORGE B. BRUCE, 3, Victoria Street, Westminster, on payment of 5s. per sheet.

By order,
HENRY W. NOTMAN,
Managing Director.

Company's Offices,
55, Gracechurch Street, London, E.C.,
November 10th, 1905.

EAST INDIAN RAILWAY.—The East Indian Railway Company is prepared to receive TENDERS for the SUPPLY and DELIVERY of—

(1) WROUGHT IRON PIPING,
(2) LEATHER BELTING, HIDES, &c.,
(3) COPPER AND BRASS TUBES,

as per Specifications to be seen at the Company's offices.

Tenders are to be sent to the undersigned, marked "Tender for Wrought Iron Piping," or, as the case may be, not later than twelve o'clock noon on Wednesday, the 29th day of November instant.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to accept the lowest or any Tender.

For each Specification a fee of £1 1s. is charged, which cannot under any circumstances be returned.

By order
C. W. YOUNG,
Secretary

Nicholas Lane, London, E.C.,
November 16th, 1905.

PAGE'S WEEKLY Contracts and Appointments Open

THE SOUTHERN MAHRATTA RAILWAY COMPANY, LIMITED.

The Board of Directors of the Southern Mahratta Railway Company, Limited, are prepared to receive TENDERS for

METALS

per the Specification, which may be seen at the offices of the Company.

The charge for the Specification is One Guinea, which will not be returned.

Tenders must be sent in, addressed to the Secretary, marked "Tender for Metals," not later than Twelve o'clock noon on Tuesday, November 28th, 1905.

The Directors do not bind themselves to accept the lowest or any Tender.

By order of the Board,
EDW. Z. THORNTON,
Secretary.

46, Queen Anne's Gate, S.W.,
November 14th, 1905.

CITY OF CARDIFF.—WHITCHURCH ASYLUM.—ELECTRIC LIGHTING.

TENDERS FOR GENERATING PLANT.

The ASYLUMS COMMITTEE of the CARDIFF CORPORATION invite TENDERS for the FOLLOWING PLANT, to be delivered and erected at the Asylum, Whitchurch, near Cardiff.

Section 1. BATTERY OF ACCUMULATORS, WITH BOOSTER.
" 2. ENGINES and GENERATORS.
" 3. SWITCHBOARD.

The Corporation reserve to themselves the right to accept any or all of the above three Sections as they may think fit.

General Conditions, Specifications, and Forms of Tender may be obtained from Mr. ARTHUR ELLIS, Central Offices, the Hayes, Cardiff, to whom a deposit of Two Guineas must be sent, which will be returned by him on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Asylum Generating Plant," to be delivered at my office on or before the 27th inst.

The lowest or any Tender will not necessarily be accepted.

By order,
J. L. WHEATLEY,
Town Clerk.

Town Hall, Cardiff.

COUNTY BOROUGH OF BURTON-UPON-TRENT.

The Corporation of Burton-upon-Trent invite TENDERS for the CONSTRUCTION, DELIVERY, and FIXING of No. 2 LANCASHIRE BOILERS, 20 ft. by 6 ft. 6 in., including all Mountings, Fittings, &c., for the Public Baths, Burton-upon-Trent.

Copies of the Specification and Form of Tender may be obtained, and the General Conditions of Contract may be inspected, at my office on and after Monday, the 20th day of November, 1905.

Sealed Tenders, endorsed "Tender for Boilers," must be delivered at my office before 10 a.m. on Wednesday, the 29th November, 1905.

No Tender will be accepted from any party who pays his employees, whether artisans or labourers, less than the standard rate of wages paid in this borough, or who does not conform to the hours and conditions of labour generally recognised in each branch of industry affected, and clauses to ensure compliance with this regulation are inserted in the General Conditions of Contract.

The Corporation do not bind themselves to accept the lowest or any Tender, and parties tendering must do so at their own expense.

GEORGE T. LYNAM,
Borough Engineer and Surveyor.

Town Hall,
November 15th, 1995.

CITY OF LAUNCESTON, TASMANIA.

ELECTRIC LIGHT DEPARTMENT.

TENDERS FOR SUPPLY OF METERS.

The MAYOR and ALDERMEN of the City of Launceston, Tasmania, are prepared to receive TENDERS for the SUPPLY of 500 or more ELECTRIC METERS and for MAXIMUM DEMAND INDICATORS.

Specifications and Conditions of Contract in duplicate may be obtained on application to Mr. WILLIAM CORIN, City Electrical Engineer, Launceston, Tasmania, or to Messrs. JOHN TERRY AND CO., 7, Great Winchester Street, London, E.C., England, on payment of Two Guineas, which sum will be refunded on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Tenders for Supply of Electric Meters," must be addressed to the undersigned and lodged in his office not later than 12 o'clock noon of Monday, the 15th day of January, 1906.

C. W. ROCHER,
Town Clerk.

Town Hall, Launceston, Tasmania,
September 25th, 1905.

APPOINTMENTS OPEN.

UNIVERSITY OF BIRMINGHAM.

ASSISTANT LECTURER ON ELECTRICAL MACHINE DESIGN.

The University of Birmingham requires the services of a MECHANICAL DRAUGHTSMAN thoroughly conversant with the best English practice in the design of dynamos, transformers, and accessory apparatus. Applicants must have had experience as leading draughtsmen in first-class electrical engineering firms. The applicant selected will enter upon his duties on the 1st January, 1906. He will have to assist the Professor by superintending the design and machine drawing of students, and by preparing wall diagrams, etc., for lecture demonstrations. The stipend is £250 per annum.

Applicants to give particulars as to age, scientific training, and practical experience, and to enclose copies (not originals) of testimonials from previous employers.

Applications to be addressed to the Secretary, and to be delivered on or before November 27th, 1905.

CITY OF AUCKLAND, NEW ZEALAND.

APPOINTMENT OF CITY ENGINEER.

Applications, accompanied by Testimonials, will be received in the Town Clerk's Office, Auckland, New Zealand, until 4 o'clock p.m. on Thursday, February 8th, 1906, for the appointment of City Engineer to the City of Auckland. Conditions of appointment may be seen, and copies obtained, at the office of the High Commissioner for New Zealand, Westminster Chambers, 13, Victoria Street, London, S.W.

HENRY W. WILSON,
Town Clerk.

September 1st, 1905.

AUCKLAND UNIVERSITY COLLEGE, NEW ZEALAND.

APPLICATIONS are invited for the PROFESSORSHIP of MINING ENGINEERING about to be established at Auckland University College, New Zealand.

Applicants must be qualified to prepare students in the subjects of applied mechanics, mining, and land and mine surveying for the examination of the University of New Zealand required for the degree of Bachelor of Engineering (Mining).

The salary is £500 per annum, in addition to the students' fees, with an engagement for five years. Private practice which did not interfere with the performance of college duties would not be objected to by the College Council.

A suitable allowance will be made for passage money, but not to exceed £100.

The successful applicant must not be over 40 years of age, and must enter upon his duties as soon as possible after January 1st, 1906.

Copies of the questions to be answered by Applicants, the Calendar of the University of New Zealand, and the Form of Agreement to be signed, may be had on application to the High Commissioner for New Zealand, 13, Victoria Street, London, S.W.

BOMBAY, BARODA, AND CENTRAL INDIA RAILWAY COMPANY.

The Directors are prepared to receive APPLICATIONS (by letter only) for APPOINTMENT as ASSISTANT ENGINEER in the Way and Works Department in India.

Two appointments will be made.

Candidates should not be more than thirty years of age, and must have received a good scientific education at a recognised Engineering College and have had thereafter at least a year's experience in practical work.

Salary, Rupees 350 per calendar month.

Terms: A three years' engagement and first-class free passage to India and home again (unless forfeited by misconduct).

The candidate selected will be required to pass a medical examination by the Company's Consulting Physician before appointment.

Letters of application, marked "Assistant Engineer," with copies (not originals) of testimonials, should be addressed to the undersigned not later than the 30th instant.

T. W. WOOD,
Secretary.

Offices: Gloucester House,
Bishopsgate Street Without, London, E.C.,
November 10th, 1905.

VACANT POST.—The Office of SUPERINTENDING ENGINEER to Det Bergenske Dampskibsselskab, Bergen, Norway, is VACANT from January 1st, 1906, for a *Norwegian*. Salary Kr. 6,000 and bonus.—Applications to be addressed to the BOARD OF DIRECTORS, DET BERGENSKE DAMPSKIBSSELSKAB, Bergen, within the end of November.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages* 35, 37, 38, *and* 40.

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Advertisers' Service Bureau.
British Advertiser Service Bureau, Queen Anne's Chambers Westminster, S.W.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Band Sawing Machines.
Noble & Lund, Ltd., Felling-on-Tyne.

Bearings (Roller).
Hyatt Roller Bearing Co., 47, Victoria Street, London, S.W.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Boiler and Crank Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.
Thompson, John, Wolverhampton.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.

Cables.
Callender's Cable and Construction Co., Ltd.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Castings.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Spottiswoode Advertising Agency, Clun House, Surrey Street, Strand, W.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Coke Oven Expert.
Mallmann, P. J., 110-118, Victoria Street, S.W.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 19, Old Queen Street, Westminster, S.W.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.
Mount-Haes, A., M.I.Mech.E., M.I.M.E., 11, Ironmonger Lane, London, E.C.

Continental Railway Arrangements.
Northern Railway of France.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Copper and Brass.
W. Hepton & Son, Hunslet Lane, Leeds.

Coverings (Boiler).
Magnesia Covering Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne
Swift, George, Clarence Ironworks, Halifax.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 16, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
British Westinghouse Electric and Manufacturing Co., Ltd., Norfolk Street, Strand, London, W.C.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Ebonestos Manufacturing Co., 22, Rosoman Street, London, E.C.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., Silvertown, London, E.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
New Gutta Percha Co., Ltd., Dashwood House, New Broad Street, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Scott, E., & Mountain, Ltd., Newcastle-on-Tyne.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co. (*see* Ebonestos Manufacturing Co.), 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax.
Cundall, Son & Co., Ltd., Airedale Iron Works, Shipley.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E

PAGE'S WEEKLY Testing Machines

BY ROYAL WARRANT TO H.M. THE KING

W. & T. AVERY LTD.

ESTD 1730

SOHO FOUNDRY

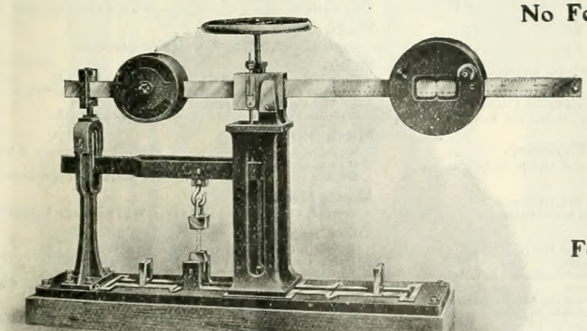
BIRMINGHAM

THE LARGEST MAKERS OF WEIGHBRIDGES IN THE WORLD

AVERY'S COMBINED TESTING MACHINE

FOR CAST IRON.

No Foundry should be Without One.



For Tensile and Transverse Tests.

A mere statement is NOT proof, but Iron that has been tested by AVERY'S TESTING MACHINE has been proved beyond doubt.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gauges (Pressure, Vacuum, and Hydraulic).
Dobbie, McInnes, Ltd., 45, Bothwell Street, Glasgow.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Angus, G. & Co., Ltd., Newcastle-on-Tyne.
Asquith, William, Ltd., Well Road Works, Halifax.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Swift, George, Clarence Ironworks, Halifax.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Hydraulic Machine Tools.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Vauxhall and West Hydraulic Engineering Co. Ltd., 23, College Hill, London, E.C.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 45, Bothwell Street, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Allen, Edgar, & Co. Ltd., Imperial Steel Works, Sheffield.
Askham Bros. & Wilson, Ltd., Sheffield.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds. England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co,, Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Asquith, William, Ltd., Well Road Works, Halifax.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Parsonage Works, Keighley.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Clarence Ironworks, Halifax.

Lathe Carriers
Williams, J. H., & Co., Brooklyn New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
Asquith, William, Ltd., Well Road Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Beanland, Perkin, & Co., School Close Works, Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Consolidated Pneumatic Tool Co., Ltd., Palace Chambers, 9, Bridge Street, Westminster, S.W.
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Fengl, A., & Co., Grafton Street, Altrincham.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund. Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Resides, 12, Aire Street, Brighouse, Yorks.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Clarence Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill Birmingham.
Vauxhall and West Hydraulic Engineering Co., Ltd., 23, College Hill, London, E.C.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co. (see Vauxhall and West Hydraulic Engineering Co. Ltd.), 23, College Hill, London, E.C.
Winn, Charles, & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., East Greenwich, London, S.E.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.
Brown, Andrew, & Co., 110, Cannon Street, London, E.C.
Méguin, Fr., & Co., Ltd., Engineering Works, Dillingen-on-Saar.

Mining Machinery.
Fraser & Chalmers, Ltd., 3 London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Inglesant, T., & Sons, Ltd., Atlas House, Leicester.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rookwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Oil Filters and Cabinets.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London E.C.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United States Metallic Packing Co., Ltd., Bradford.
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C

Patent Agents.
Page & Rowlingson, 28 New Bridge Street, London, E.C.

PAGE'S WEEKLY Pumping Machinery

Pumping Machinery

FOR WATERWORKS AND MINES.

Official Trial.

Engine Dimensions.

Diameter of Cylinders:—20in., 36in., 54in.

Rams, 3 Single Acting:—Each 30in. in dia.

Stroke of Engine and Pump:—3 ft. 6in.

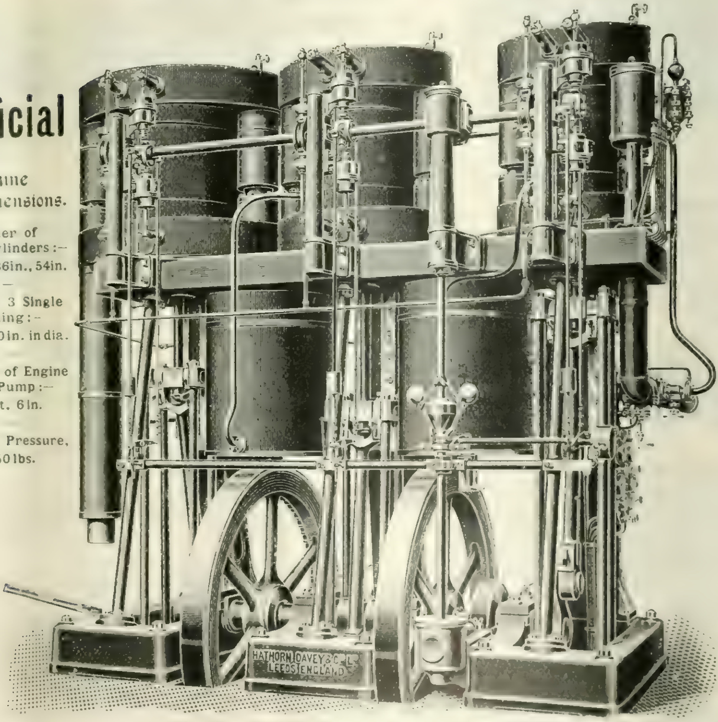
Steam Pressure, 150lbs.

Engine Results.

Pump Horse Power: 274·55.

Saturated Steam per Indicated Horse Power per hour: 12·4 lbs.

Mechanical Efficiency: 92·8 per cent.


HATHORN DAVEY & C° L
LEEDS ENGLAND

Contract Duty to raise 6,240 Gallons of sewage per minute 125 feet high.

Triple Expansion Sewage Pumping Engine, Melbourne and Metropolitan Board of Works.

HATHORN, DAVEY & Co., LIMITED.

Codes Used
A.B.C 4th Edition.
Universal Mining Code

LEEDS, England.

Telegrams
HATHORN, LEEDS.

Buyers' Directory—(*Continued*).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W

Photographic Apparatus.

Marion & Co., Ltd., 22 and 23, Soho Square London, W

Pinch Bars.

Samson & Co., Garforth, near Leeds.

Pipe Wrenches (Chain).

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Pneumatic Tools.

Consolidated Pneumatic Tool Co., Ltd., Palace Chambers, 9, Bridge Street, Westminster, S.W.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C
Spon, E. and F. N., 125 Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 27 Charles Street, Bradford
Enke, Carl, Schkeuditz Leipzig, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.

Radial Drilling Machines.

Asquith, William, Ltd. Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds
Mitchell, D., & Co. Ltd., Parsonage Works, Keighley.
Niles-Bement-Pond Co., 23-25 Victoria Street, London, S.W
Noble & Lund, Ltd., Felling-on-Tyne
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax
Swift, George, Clarence Ironworks, Halifax.

Rails.

Wm. Firth Ltd. Leeds.

Riveted Work.

P. A. Keep, Juxon & Co. Forward Works, Barn Street, Birmingham

Roller Bearings.

[illegible], Victoria Street, London, S.W

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works, Belfast
Head, Wrightson & Co., Ltd., Thornaby-on-Tees
[illegible] Road [illegible]

Ropeways (Aerial).

[illegible] Lane, London, E.C

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd., Cambridge.

Slotting Machines.

[illegible] Halifax

Spanners.

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stampings.

Thomas Smith & Sons of Saltley, Ltd., Birmingham
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham

Stamps (Metal).

Edward Pryor & Son, 68 West Street, Sheffield.

Steam Traps.

British Steam Specialties Ltd., Fleet Street, Leicester
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Steel Structures.

Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 30, Deansgate, Manchester

Time Recorders.

Howard Bros., 40, Paradise Street, Liverpool, and [illegible] Queen Victoria Street, London, E.C
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

Tubes.

Thomas Piggott & Co., Ltd., Spring Hill, Birmingham
Tubes, Ltd., Birmingham.

Turbines.

Greenwood & Batley, Albion Works, Leeds
S. Howes Co., 64, Mark Lane, London, E.C

Typewriters.

Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50 Holborn Viaduct, London, E.C

Valves.

Holmes & Co., W. C., Huddersfield.
Hopkinson, J. & Co. Ltd. Britannia Works, Huddersfield
Hunt & Mitton, Crown Brass Works, [illegible] Street North, Birmingham
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow
Shaw, Joseph, Albert Works, Huddersfield
Winn, Charles & Co., St. Thomas Works, Birmingham

Ventilating Appliances.

Matthews & Yates, Ltd., Swinton, Manchester

Water Softeners and Purifiers.

[illegible]

Wagons Steam.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.

Weighing Apparatus.

W. & T. Avery, Ltd., Soho Foundry, Birmingham
Samuel Denison & Son, Hunslet Foundry, Leeds

Wells Light.

A. C. Wells & Co., 100A Midland Road, St. Pancras, London, N.W.

Wire Working Machinery.

[illegible]

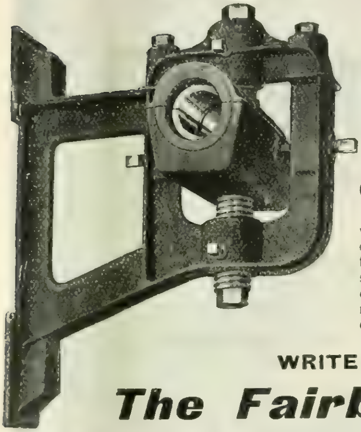
"Woodite."

"Woodite" Company, [illegible]

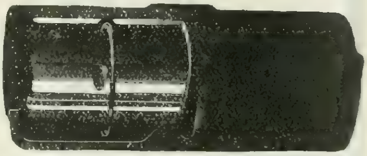
PAGE'S WEEKLY Miscellaneous

UNIVERSAL GIANT

Ring Oiling Ball and Socket Bearing.



Length of Bearing = Four Diameters of Shaft.



OUR improved Ring Oiling type of Bearing is **unquestionably without an equal.** **Perfect oiling** of the shaft has been arranged for by means of tempered steel rings which hang on the shaft and which are enough larger in diameter to permit the lower side to run in the oil of reservoir. As the shaft revolves, these rings revolve with it and they **continually convey a generous amount of oil** up on top of the shaft from which it works over the entire bearing surface. A special device is provided at each end of the Bearing by which all **surplus oil** is returned to the **reservoir** thus allowing **the oil to be used over and over again,** and doing away with **troublesome oil drip pans.**

WRITE FOR CATALOGUE NO. 181.

The Fairbanks Company,

GLASGOW OFFICE: 56, Bothwell Street. **78-80, City Road, LONDON, E.C.**

In Crown 8vo extra. With Diagrams and Folding Plate. 8s. 6d.

THE CALCULUS FOR ENGINEERS AND PHYSICISTS

Applied to Technical Problems.

With Extensive Classified Reference List of Integrals.

By PROFESSOR ROBERT H. SMITH, A.M.Inst.C.E., M.I.Mech.E.

Assisted by R. F. MUIRHEAD, M.A., B.Sc.

"Professor R. H. Smith's book will be serviceable in rendering a hard road as easy as practicable for the non-mathematical student and engineer."—*Athenæum.*

In 4to Boards. 7s. 6d.

MEASUREMENT CONVERSIONS.

(English and French.)

Twenty-eight Graphic Tables or Diagrams showing at a glance the Mutual Conversion of Measurements in Different Units of Lengths—Areas—Volumes—Weights—Stresses—Densities—Quantities of Work—Horse-Powers, &c.

By PROFESSOR ROBERT H. SMITH, A.M.Inst.C.E., M.I.Mech.E.

"Ought to be in every office where even occasional conversions are required."—*Electrical Review.*

Strongly Bound, in Super Royal 8vo. Cloth Boards. 7s. 6d. net.

Bonus Tables:

For Calculating Wages on the Bonus or Premium Systems.

By HENRY A. GOLDING, A.M.I.Mech.E.

"Cannot fail to prove practically serviceable to those for whom they have been designed."—*Scotsman.*

SIXTH EDITION. Folio, Strongly Half-Bound. 21s.

Traverse Tables:

Computed to Four Places of Decimals for every Minute of Angle up to 100 of Distance.

By RICHARD LLOYD GURDEN,

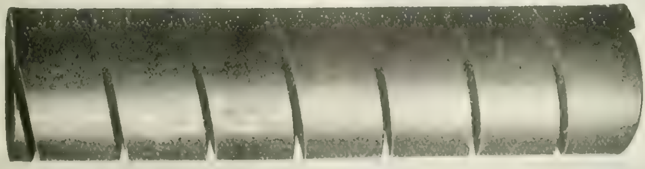
Authorised Surveyor for the Governments of New South Wales and Victoria.

"[illegible] of this publication will remain without them."—*[illegible]*

London: CHARLES GRIFFIN & CO., Ltd., Exeter Street, Strand, W.C.

For Highest Efficiency, use Hyatt FLEXIBLE Rollers on Cranes, Trolleys, Bogies, Shafting, Motor Cars, and Motor Lorries.

Durability and Efficiency Guaranteed.



Sent on Trial FREE.

HYATT ROLLER BEARING CO., 47, Victoria Street, London, S.W.

The Kalk Machine Works

BREUER, SCHUMACHER

& Co., Ltd.,

KALK, near Cologne-on-Rhine
(**GERMANY**).

Department I.

MACHINE TOOLS.

Department II.

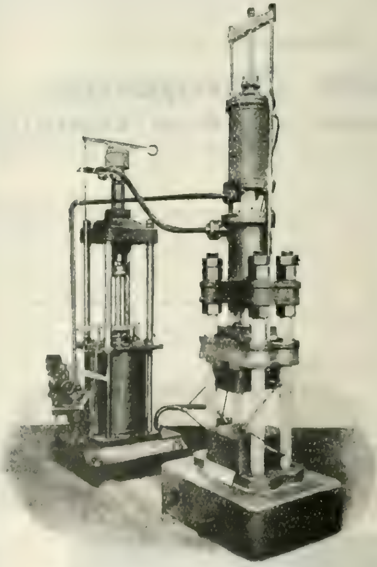
AUXILIARY MACHINERY FOR STEEL WORKS, &c.

Department III.

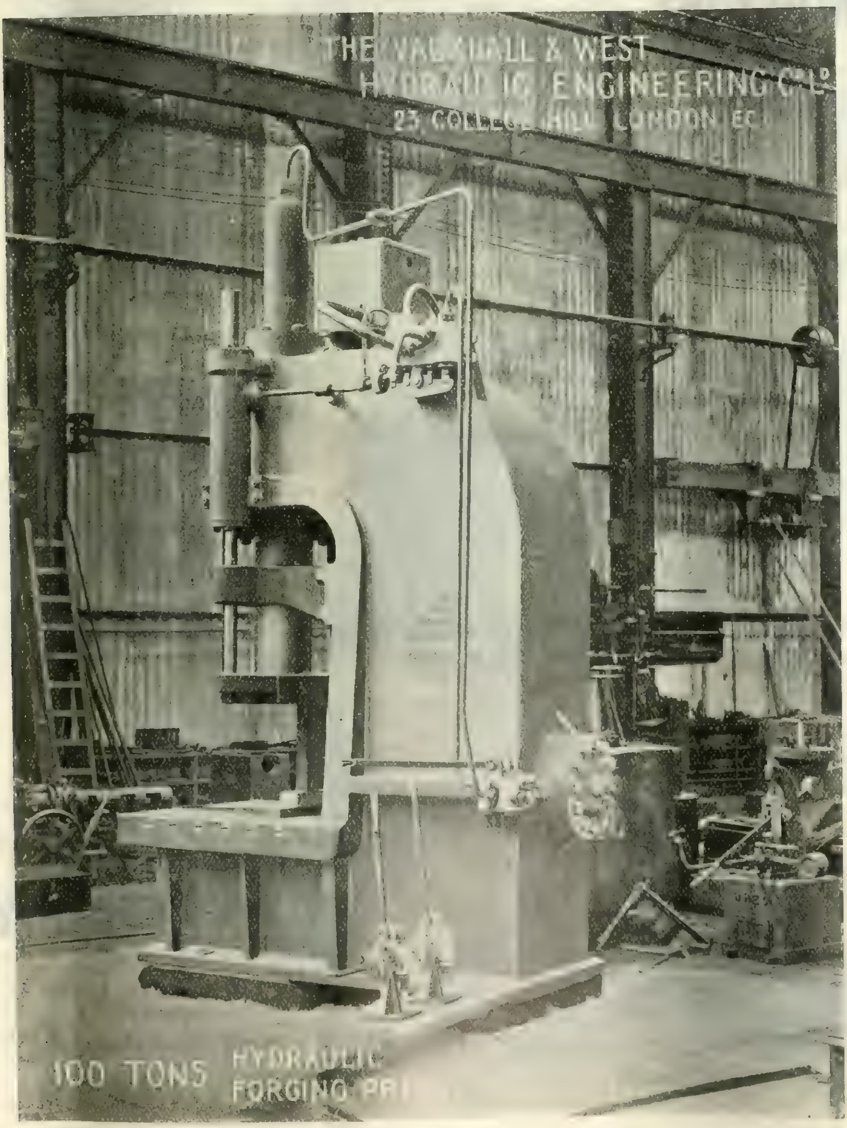
ROLLING MILL PLANTS.

Department IV.

HYDRAULIC MACHINERY.



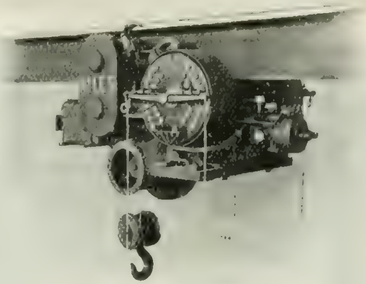
PAGE'S WEEKLY Hydraulic Machine Tools



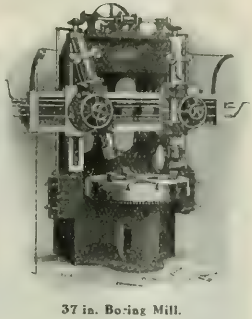
PAGE'S WEEKLY Machine Tools

MACHINE TOOLS.

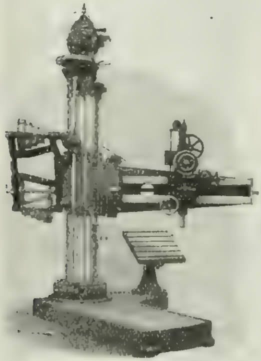
ELECTRIC TRAVELLING CRANES and HOISTS.



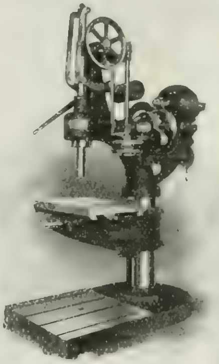
3 ton Electric Hoist.



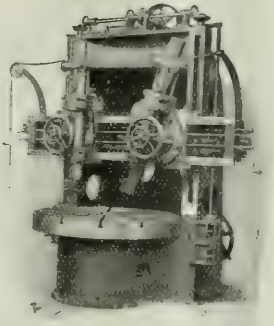
37 in. Boring Mill.



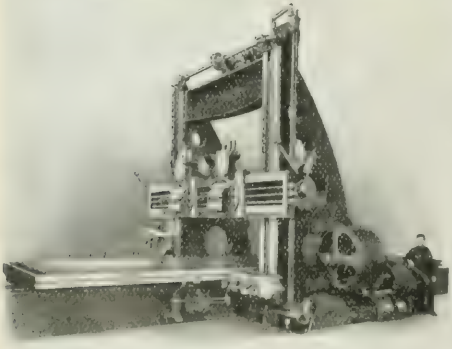
5½ft Universal Radial Drill.



50 in. Vertical Drill.



51in. Boring Mill.



10 ft. Planer, Pneumatic Clutches.

Complete Equipment for Locomotive, Machine, and Repair Shop.

Niles-Bement-Pond Company

NEW YORK, U.S.A.

23-25, Victoria Street, London, S.W.

TELEGRAMS —

"NILESCO, NEW YORK." "NILIACUS, LONDON

PAGE'S WEEKLY Machine Tools

Radial Drilling Machines.

NEW AND IMPROVED DESIGNS.
DISPENSING WITH OVERHANGING TOP SHAFT

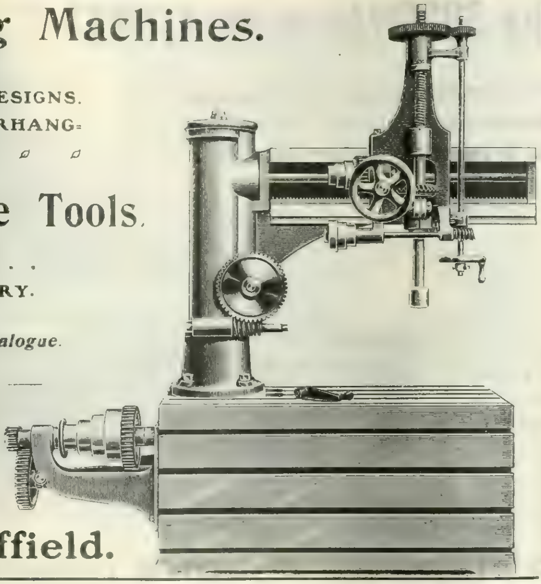
High-Class Machine Tools.

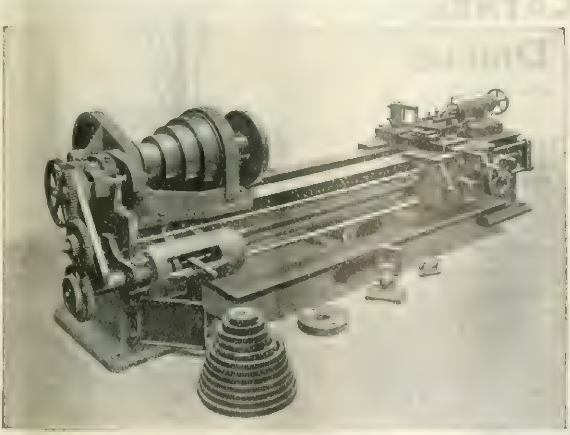
IN STOCK FOR . . . .
IMMEDIATE DELIVERY.

Send for Descriptive Catalogue.

THOS. W. WARD, LTD.,
Albion Works,
Sheffield.

Telegrams.—
"FORWARD, SHEFFIELD."





WE MAKE
HIGH-SPEED
LATHES
A Speciality.

"ACCURATE."
"DURABLE."
"POWERFUL."
8½in., 10in., and 12in. Centres.

REASONABLE IN PRICE.
UNEQUALLED IN POWER.

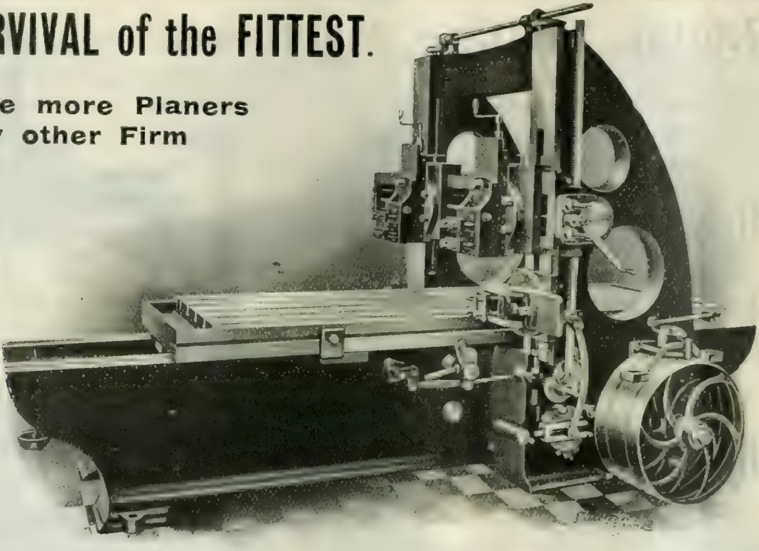
Send us your
Inquiries.

NOBLE & LUND, LIMITED,
FELLING-ON-TYNE.

PAGE'S WEEKLY Machine Tools, &c.

The SURVIVAL of the FITTEST.

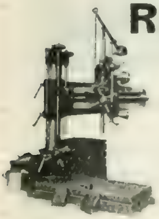
We make more Planers than any other Firm in Great Britain.



Ask specially for Planing Machine Catalogue.

C. REDMAN & SONS, Pioneer Ironworks, HALIFAX.

HIGH-CLASS LATHES
AND
RADIAL DRILLS.



Write for our Lists.

D. MITCHELL & CO., Ltd.,
Parsonage Works, KEIGHLEY.

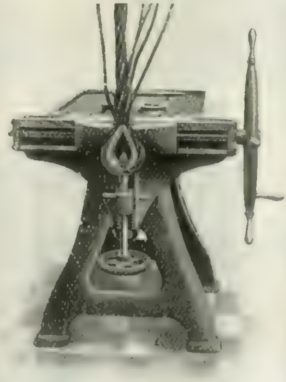
Telegrams: "TOOLS, KEIGHLEY."

On War Office and India Office Lists.

SWING JIB COUNTERSINK
RADIAL DRILL
For BRIDGE and SHIPBUILDERS

Makers of all kinds of **MACHINE TOOLS.**
Large stock ready for delivery.

G. F. SMITH, Ltd.,
South Parade,
HALIFAX.



Cable Bending and Splicing Vise.

SEND [illegible] DESCRIPTION

J. PARKINSON & SON,
SHIPLEY, ENGLAND.

Cables: [illegible] SHIPLEY. [illegible]

PAGE'S WEEKLY Machine Tools, &c.

WARD'S No. 2 Vertical Miller

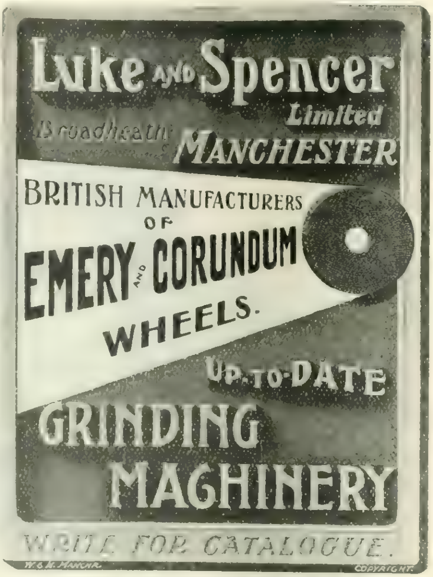
Telephone
No. [illegible]

Telegrams:
[illegible]
[illegible]

24 in. x 9 in. x 15 in.

Contractors to
British and
Foreign
Governments.

H. W. WARD & CO.,
86, Lionel Street, BIRMINGHAM.



Luke and Spencer
Limited
Broadheath MANCHESTER
BRITISH MANUFACTURERS
OF
EMERY AND CORUNDUM
WHEELS.
UP-TO-DATE
GRINDING
MACHINERY
WRITE FOR CATALOGUE.
W. & L. MANCHR. COPYRIGHT.

YORKSHIRE MACHINE TOOL & ENGINEERING WORKS,

LIVERSEDGE

Nr. LEEDS.

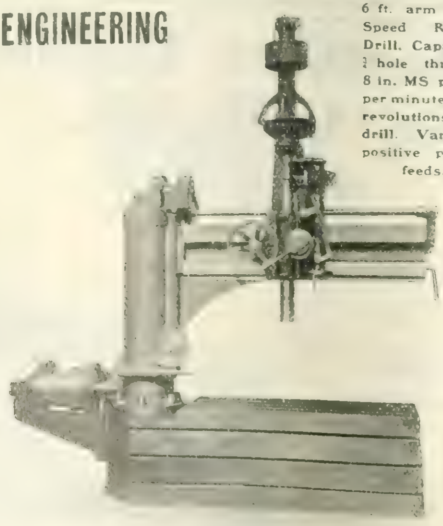
Telegraphic Address: [illegible], Liversedge.
[illegible] 3x Heckmondwike.

* *

Builders
of
High-Class Machine
Tools.

* *

Estimates given for complete
SHELL MAKING PLANT.



6 ft. arm High Speed Radial Drill. Capacity, ¾ hole through 8 in. MS plates per minute. 600 revolutions on drill. Variable positive power feeds.

PAGE'S WEEKLY Machine Tools

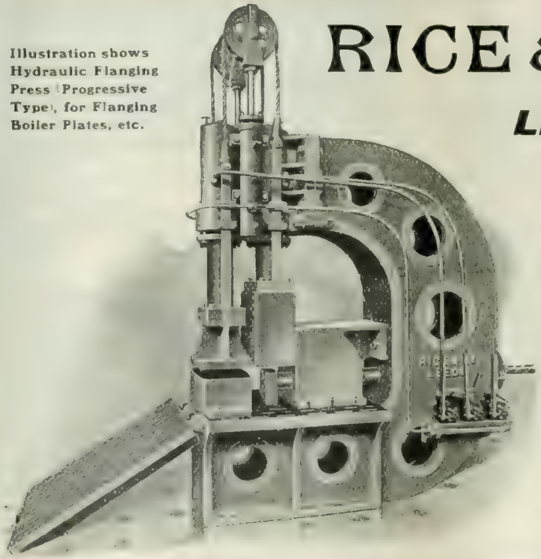


Illustration shows Hydraulic Flanging Press (Progressive Type), for Flanging Boiler Plates, etc.

RICE & CO. (Leeds), LIMITED,
LEEDS,
ENGLAND.

HYDRAULIC

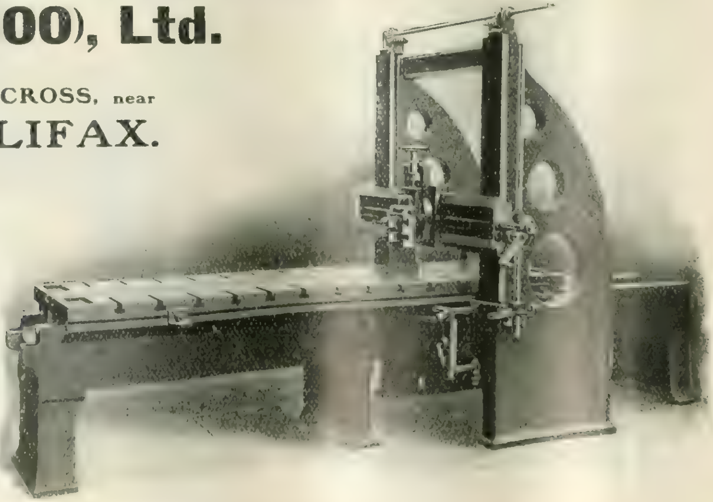
Riveters, Lifts,
Presses, Pumps,
Cranes, Accumulators,
Punches, Intensifiers,
Shears, Valves,
Hoists, &c., &c.

[illegible]
Telegraphic Address [illegible]
Telephone No. [illegible]

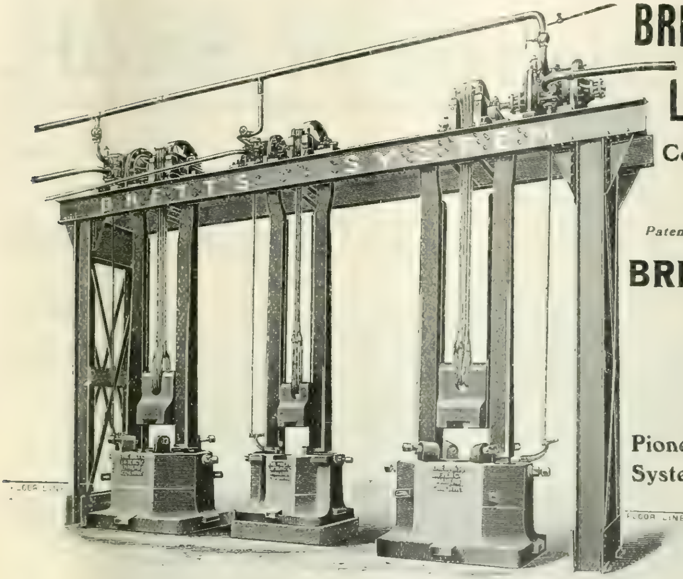
Northern Engineering Co. (1900), Ltd.

KING CROSS, near
HALIFAX.

PLANING MACHINE, from 2 feet up to 8 feet square.



PAGE'S WEEKLY Machine Tools



BRETT'S PATENT LIFTER Co. Ltd.,
Coventry, England.

Patentees and Manufacturers of

BRETT'S PATENT LIFTERS,
ETC.

Pioneers of the Modern System of Drop Forging.

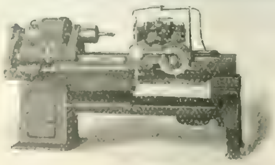
Telegraphic Address :
" LIFTER, COVENTRY."
Telephone No. : 384.

Dean, Smith, & Grace,
LTD.,
Lathe Manufacturers,
Established 1865.
KEIGHLEY.

WRITE FOR CATALOGUE.

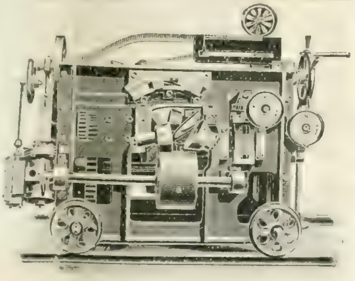
See Our Advertisement next Week.

TURRET LATHES.
BRITISH MAKE THROUGHOUT.



See our page Advertisement next week

THE ECLIPSE TOOL MANUFACTURING CO.
LINWOOD, near GLASGOW.



Patent Bevelling Machines
FOR SHIPS' FRAMES.

STEAM HAMMERS
FOR SMITHS' SHOPS AND FORGES.

Forge Cranes, Hand and Steam.

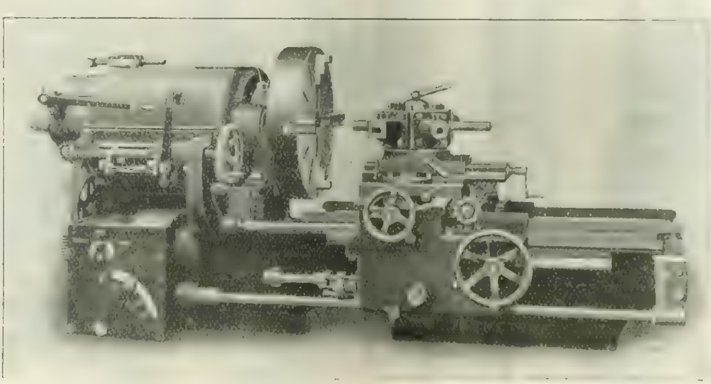
DAVIS & PRIMROSE,
Leith Ironworks, EDINBURGH.

[illegible] A1 and A B C Codes used.
[illegible] LEITH."

PAGE'S WEEKLY Machine Tools

The Perfection of Speeds.

With the Lathe illustrated here the spindle speed increases automatically as the tool travels towards the centre. Herein is the Perfection of Speeds, as at whatever diameter the tool begins to cut the correct speed may be used.



If you are doing Surfacing work on Lathes, you must investigate LANG'S PATENT VARIABLE SPEED DRIVE. We can now machine a surface in half the time you can.

DOES THIS FACT INTEREST YOU?

NO COUNTER MOTION REQUIRED

with these Lathes.

VISITORS WELCOME.

JOHN LANG & SONS,

Johnstone, near Glasgow.

PAGE'S WEEKLY Machine Tools

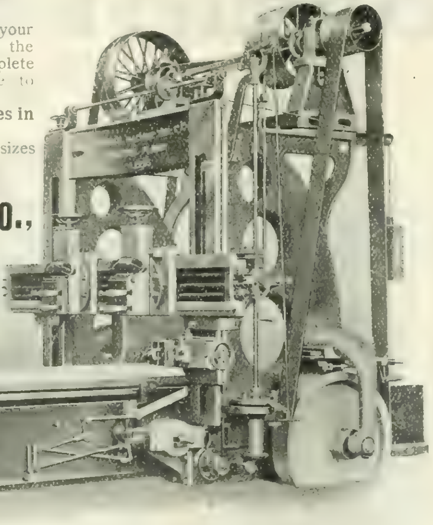
COUNT THE CYCLES.

THIS is more accurate than gauging the efficiency of your planers by **maximum speeds only,** because of the time lost on reversing. The time of a cycle (the complete "cut" and "return" journey) includes the loss due to acceleration at both **ends** of the stroke.

The High-Speed Planer illustrated completes **10 cycles in 4 minutes** when on a 12 ft. stroke.

Write for our table showing speeds of the various sizes for comparison with your own planers.

Bateman's Machine Tool Co.,
LIMITED,
Hunslet,
LEEDS.



60 in. by 60 in. by 12 ft. Patent High-Speed Planer, cutting 40 ft. p.m., returning 140 ft. p.m.

ANOTHER LINK IN THE CHAIN OF PROGRESS.

Our **SMALL RADIAL** has recently been **improved,** and can now be fitted with **Automatic Trip** Motion. Spindle **practically equal** to sensitive.

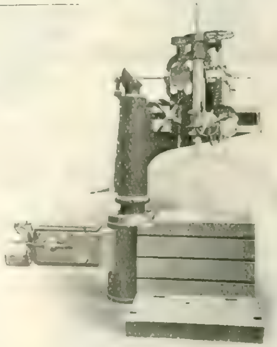
Great power and efficiency for

HIGH-SPEED DRILLING.

No Cones. No Countershaft.

Sole Makers—

WILLIAM ASQUITH, LTD.,
Well Road Works,
HALIFAX, ENGLAND.



SEND FOR LISTS.

PAGE'S WEEKLY Machine Tools, &c.

CUNLIFFE & CROOM, Ltd.

MACHINE TOOL MAKERS,

Broughton Lane, MANCHESTER.

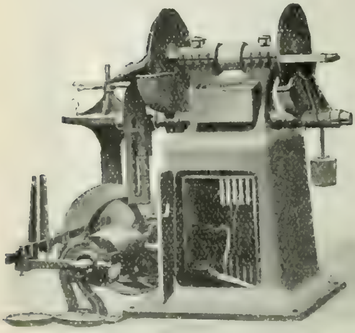


Illustration shows 18-in. Disc. Grinder. May be seen at work at our Showroom,
66, VICTORIA STREET, MANCHESTER.

DISC GRINDERS.

Made in Three Sizes: 14 in., 18 in., and 28 in.

Accessories supplied with each machine are—
Screw Press; Two extra machine ground Steel Discs; Dust Shields to each Disc; One dozen Emery Paper Discs; Water Trough; Glue Kettle; Handles for lifting discs; Top Driving Apparatus.

Full particulars and printed matter free on application.

FIREWOOD AND LIGHTER MACHINERY

DOES THE WORK of from 12 to 80 MEN.

A CERTAIN

ONLY "IDEAL" SAW GUARDS CAN FIT ANY SIZE

IF GUARDS BIND OR DO NOT FIT EXPECT ACCIDENTS AND LESS WORK

M. GLOVER & Co LEEDS.
PATENTEES
FIRE WOOD & LIGHTER MACHINERY, &c.

THE SAVING IN WAGES ALONE REPRESENTS

LARGE INCOME.

Gve. DETOMBAY, Mce. DELANGE & Cie.

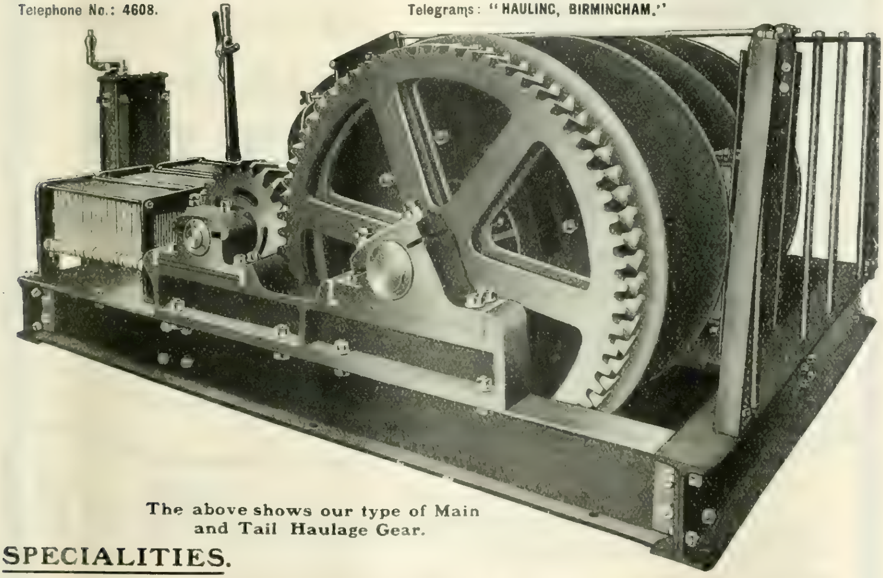
Engineering Works, HOBOKEN, near ANTWERP.

Specialities: APPLIANCES FOR PUBLIC WORKS:—Dredgers.—Elevators.—Excavators.—Tugs.—Centrifugal Pumps.—Sand Pumps.—Ballast Barges.—[illegible].—Yachts.—Hand, Steam and Hydraulic Cranes.—Drawbridges.—Pontoons.—Derricks.—Hand and Steam Winches.—Steam Engines.—Traction Engines.—Plant for Blast Furnaces.—Steel Works, Rolling Mills.—Gasholders.—Steam Hammers.—Shearing and Plate-edge Planing Machines, &c.

ELECTRIC MINING MACHINERY.

Send us Particulars of your requirements, or Sketch of your Workings, when we will submit to you the most Economical Method and our Lowest Prices.

Telephone No.: 4608. Telegrams: "HAULING, BIRMINGHAM."



The above shows our type of Main and Tail Haulage Gear.

SPECIALITIES.

Our Specialities are: Secondary Haulage, Electrically Driven Three-throw Pumps, Main and Tail, Main Rope, Endless Rope, and Portable Hoisting and Hauling Gears.

M. B. WILD & CO.,

Mechanical and Electrical Engineers.

Head Offices:—

35 & 36, Clarence Chambers, Corporation Street,
BIRMINGHAM.

Works: NECHELLS, BIRMINGHAM.

EVERY READER A BUYER

The great difficulty with the circulation of the average engineering paper is that there is so much "dead timber" in it—so many persons who are not interested in the advertising columns.

NO DEAD TIMBER IN

PAGE'S WEEKLY.

It goes to men who read advertisements and answer them.

Its yearly subscribers are the Directors and Managers of the leading Shipbuilding Yards, Engineering Shops, Iron and Steel Works and Electrical Stations; Government Officials, Colliery Owners and Managers, Contractors, Consulting Engineers, and Borough Surveyors.

A considerable portion of its foreign circulation is among Managers of Mines, Machinery Merchants, Planters, Superintendents of Irrigation Works and Railway Officials, in the following countries:

FOREIGN DEPT. 1.—Australia, Tasmania, New Zealand, South Africa and the Malay Peninsula.

FOREIGN DEPT. 2.—Canada, Newfoundland, Mexico, West Indies, British Guiana, Venezuela, Columbia, Brazil, Peru, Chili, Argentina, and Uruguay.

FOREIGN DEPT. 3.—India, Indo-China, Chinese Empire, Japan, Siberia, Russian Turkestan, and Caucasia.

FOREIGN DEPT. 4.—Egypt, The European Continent, and North Africa.

May we quote you rates for a trial advertisement contract?

THE ADVERTISEMENT MANAGER.

Clun House, Surrey Street,
Strand, London, W.C.

PAGE'S WEEKLY Steelwork, &c.

CLAYTON, SON & Co., LTD.

HUNSLET, LEEDS,

MAKERS OF THE

LARGEST STEEL TANK

AND THE

LARGEST GASHOLDER IN THE WORLD.

ROOFING,
CONSTRUCTURAL STEEL WORK,
PETROLEUM TANKS.

Wires:— "Gas, Leeds."

London Office:— 60, Queen Victoria Street.

QUICK DELIVERY.

Blast Furnace

Casings and Shells

Rivetted Steel Mains

Kilns
Gantrys
Coke Ovens & Cars
Furnaces and Stoves
Chimneys & Tanks
Drops
Mains.

Up to any Diameter

Castings

Cast Iron Pipes

Necks
Grids
Bells & Hoppers
Gas and Air Valves
Stancheons
Columns
Pipes.

Up to any Diameter

Steel Structures

Send for Estimates.

ASHMORE, BENSON, PEASE & Co. Ltd, Stockton on Tees

Telegrams: Gasholder

The Phosphor Bronze Co., LTD.,

SOUTHWARK, LONDON, S.E.

Sole Makers of the Original "Cogwheel" and "Vulcan" Brands of Dr. Kunzel's

"PHOSPHOR BRONZE" ALLOYS

which have for many years been recognised as

THE BEST & MOST DURABLE METALS

for,

Slide Valves, Bearings, Bushes, Eccentric Straps, and other parts of Machinery Exposed to Friction and Wear.

Also for Pump Rods, Pumps, Piston Rings, Pinions, Worm Wheels

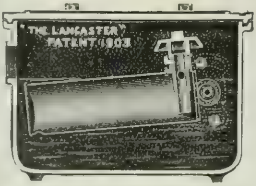
MOTOR GEARING, Etc.

Castings in Phosphor Bronze, Gun Metal, Manganese Bronze Aluminium Alloys. Machined if required

PHOSPHOR BRONZE,
MANGANESE BRONZE,
"WHITE ANT" METAL,
PLASTIC METAL,
BABBITTS METAL,
ALUMINIUM ALLOYS.

"The Lancaster" (R.T.M.)

STEAM TRAPS.



These Traps, besides being economical, efficient, and reliable, can be opened and examined while working.

By means of our patent Dirt Arrester, dirt is prevented from entering the trap, and thus a frequent source of steam trap failures is avoided. Write for Catalogue C.

FIRST ORDERS SENT ON APPROVAL.

LANCASTER & TONGE, Ltd., PENDLETON, MANCHESTER.

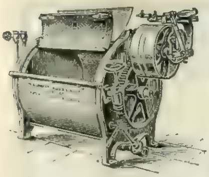
"THE LANCASTER" PISTONS, METALLIC PACKINGS, STEAM DRYERS, SPIRAL SPRINGS, etc.

DENISON'S SPRING TESTING MACHINE

Specially adapted for the use of Railway Carriage Builders, Wagon Builders, Motor Car Builders, Spring Makers, and Railway Companies.

Saml. Denison & Son, Ltd., Hunslet Moor, Near LEEDS.

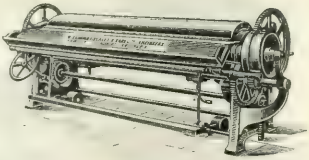
PAGE'S WEEKLY. Miscellaneous



LAUNDRY

MACHINERY

and Steam COOKING APPARATUS.



Please write for our New Catalogue, **N.**

Summerscales, Ltd., KEIGHLEY,
ENGLAND.

ARTHUR CORT & CO.,

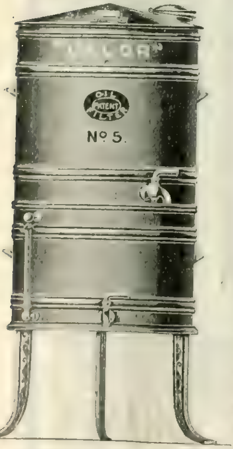
CAMBERWELL, LONDON, England.

MANUFACTURER OF

Vulcanised Fibre. **Balata & Cotton Belting.**
Gutta Percha. **Chatterton Compound.**

Telegrams: "CORT, CAMBERWELL, LONDON."

"VALOR" PATENT WASTE OIL FILTER.



BEST AND MOST EFFECTIVE IN THE UNITED KINGDOM.

For thoroughly cleansing dirty oil so that it can be re-used.

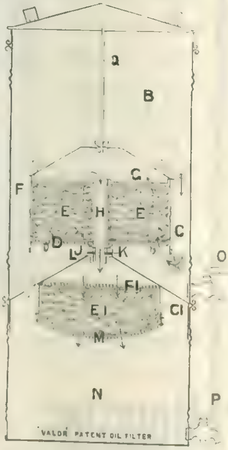
NO CHANCE FOR ARGUMENT.
TO YOUR PROFIT AND ADVANTAGE.

It saves your oil. It saves your money
WHAT MORE DO YOU WANT?

Use the "Valor" Patent Oil Filter which will Repay its Initial Cost in a few weeks.

Cases Free and Carriage Paid to any Railway Station in England and Wales.

No.	To Filter per week. Approx. Gallons	Capacity, Gallon		[illegible]	[illegible]	[illegible]
		Filtered Oil	[illegible]			
1	2 to 4	1½	[illegible]	[illegible]	[illegible]	39/-
2	3 to 6	2	[illegible]	[illegible]	[illegible]	46 6
3	8 to 16	4	[illegible]	[illegible]	[illegible]	50
4	12 to 24	6	[illegible]	[illegible]	[illegible]	75/
5	15 to 30	11	[illegible]	[illegible]	[illegible]	100
6	20 to 50	12	[illegible]	[illegible]	[illegible]	120/-



THE VALOR COMPANY, Ltd., ROCKY LANE.
ASTON CROSS **BIRMINGHAM.**

PAGE'S WEEKLY Aerial Ropeways

ADOLF BLEICHERT & Co., LEIPZIG-GOHLIS, GERMANY

OLDEST AND LARGEST FACTORY FOR THE CONSTRUCTION OF BLEICHERT'S

WIRE ROPEWAYS

Best and cheapest medium of transportation for all kinds of material for any distance and within factories.

All topographical difficulties overcome by our Patent Jaw-Grip Coupling Apparatus.

"Automat."

More than 1,600 Plants were constructed by us, some of a length of 34 kilometres.

30 Years' Experience.

Gold Medals. Highest Awards.

We have built plants with gradients of 1 : 1, and spans of over 1,000 metres.

First-class references from first-rate houses.

Wire-Ropeway executed for Sucreries Centrales de Wanze Soc. Anomyme, Wanze (Belg.).

Special Department for the Construction of

HOISTING & CONVEYING MACHINES, CRANES.

PAGE'S WEEKLY Transporters, &c.

Temperley Transporters.

Telegraphic Address:
"TRANSUMO, LONDON."

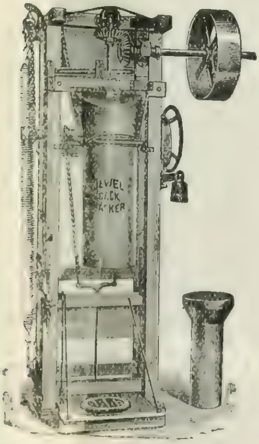
Telephone No:
365 LONDON WALL.

Temperley Patent Fixed Transporter and Travelling Tower Transporter working in conjunction at West Middlesex Water Works, unloading coal and distributing over storage ground. Load, 35 cwt.

For Rapid and Economical Handling of General Cargo, Coal, Ore, &c.

TEMPERLEY
TRANSPORTER
COMPANY,
72, Bishopsgate Street
Within, London, E.C.

THE "IRON KING" PACKER.



Automatic Friction-Clutch Cement, Lime, Alkali, Plaster, Paint, and Facings Packer = = = =

Over 7,000 in Use.

Specially adapted for all kinds of similar materials.

PACKING RAPIDLY AND ACCURATELY IN BARRELS OR SACKS.

MANUFACTURERS OF POWER TRANSMISSION MACHINERY.

THE S. HOWES CO., LONDON, E.C.
64, MARK LANE.

THIS IS THE HIDE THAT
SCHIEREN TANS

in this, the "Dixie" Tannery, and

SCHIEREN
BELTING

[illegible] been put into running order
[illegible] wherever power
[illegible] be transmitted with [illegible]
[illegible]y and economy.

Do you use Schieren Belting?
You probably would do so if you
knew how good it is.

Send for our Dixie [illegible] Leather
[illegible]

Chas. A. Schieren & Co.

45-51, FERRY STREET,
NEW YORK, U.S.A.

PAGE'S WEEKLY Systems for Engineers

To the Man at the Head of Affairs!

Do you know that many of the most progressive business houses in Great Britain have discovered the great utility of card systems as applied to business records?

Do you know that by the adoption of these systems they have effected a saving of 50 to 75 per cent. in labour over the older methods of record keeping in books?

Do you know that they have been enabled to secure data and statistics that it was practically impossible to obtain by means of book records, and that the possession of these statistics has saved the time, and made more effective the efforts of **the man at the head of affairs.**

If you are not conversant with these systems, write us. If you do not use these systems, write us. If you have any difficult business problem you want elucidated, write us.

A Coupon is provided below, and if you will fill in your name and address and mark what subjects you are interested in, we will be pleased to advise you by post; or, if convenient, we will have a representative call, who will discuss the matter with you, without charge or other obligation.

Messrs. ROCKWELL-WABASH CO., LTD.,

69, Milton Street, London, E.C.; 164, Buchanan Street, Glasgow: 50, Deansgate Arcade, Manchester.

Please have your representative call and discuss with [illegible] ……………………, or send us your Information Forms relating [illegible] to us.

Name ______________________

Address ______________________

Business ______________________

P—24.

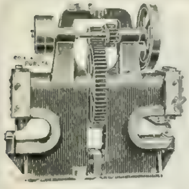
1. FACTORY COSTS
2. STORES LEDGERS
3. PERPETUAL CARD LEDGERS
4. QUOTATIONS—GIVEN
5. QUOTATIONS—RECEIVED
6. ADVERTISING RECORDS FOR ADVERTISERS
7. ADVERTISING RECORDS FOR AGENTS
8. ADVERTISING RECORDS FOR PUBLISHERS
9. STAFF REGISTER
10. CUSTOM[illegible]
11. ADDI[illegible]
12. FOLL[illegible]
13. FOLL[illegible]
14. CRE[illegible]
15. SHAFT [illegible]
16. FILIN[illegible]
17. FILI[illegible]
18. FILIN[illegible]
19. PATTERN RECORDS
20. DRAWING RECORDS
21. OLDER SYSTEMS
22. DOCTORS, DENTISTS, AND OCULISTS
23. MEMBERSHIP RECORDS
24. INSURANCE RECORDS FOR COMPANIES
25. INSURANCE RECORDS FOR BROKERS
26. INSURANCE RECORDS FOR AGENTS

PAGE'S WEEKLY Miscellaneous

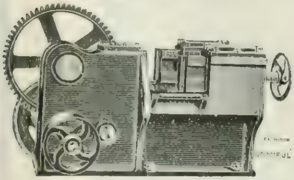
MACHINE TOOLS

FOR

Engineers,
Shipbuilders,
Boiler
Makers,
Etc., etc.



Double Ended Punching and Shearing Machine

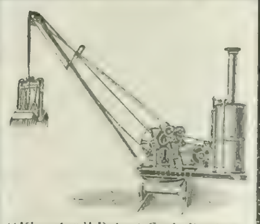


Bertrams' Angle Iron Bending and Straightening Machine

London Office:
Moorgate
Station
Chambers,
E.C.

BERTRAMS, LTD.
St. Katherine's Works, Sciennes,
EDINBURGH.

OIL MILLS & FEEDING CAKE MILLS
of latest & most up-to-date type.
GRAB DREDGERS & EXCAVATORS
HYDRAULIC LEATHER PACKINGS.



"Kingston" Patent Grab-Dredger.

ROSE, DOWNS & THOMPSON, LTD
OLD FOUNDRY, HULL and
12, Mark Lane, LONDON, E.C.

Sankey's Fire Bricks and Fire Cements.

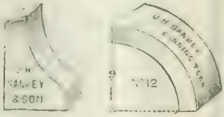
Every Description of FIRE-CLAY GOODS. STOCK UNEQUALLED.

VARIOUS BRANDS

Engineers' Designs made to Order of the best Fire-resisting Materials.

WRITE FOR NEW CATALOGUE.

SANKEY'S SEATERS AND COVERS.



J. H. SANKEY & SON
J. H. SANKEY CANNING TOWN
No 12

J. H. SANKEY & SON, Ltd., Head Office. Essex Wharf, CANNING TOWN, E.
ESTABLISHED 1857. (Contractors to H.M. Government.

HIGH-CLASS LUBRICANTS FOR MACHINERY OF EVERY DESCRIPTION.

LAND and MARINE ENGINE and CYLINDER OILS.
DYNAMO and GAS ENGINE OILS.
CRANK CHAMBER and STEAM TURBINE OILS.
MOTOR and CYCLE OILS
SOLIDIFIED OILS and GREASES for all PURPOSES.

BLUMANN & STERN, LTD., Plough Bridge, Deptford, LONDON, S.E.
Contractors to H.M. Government. Home, and Foreign Railways, &c.

Index to Advertisers.

Advertisements not appearing this week will be found by reference to the preceding or following issues, with the exception of those appearing monthly.

* See [illegible]

	PAGE
*Addy, George, & Co.	
*Ahlers, Ad.	
*Allen, Edgar, & Co., Ltd.	
Allgemeine Elektricitäts-Gesellschaft	57
Allis-Chalmers Co.	
Anderson, & Son, Ltd., D.	53
*Angus, George & Co., Ltd.	—
Ashmore, Benson, Pease & Co., Ltd.	27
*Askham Bros. & Wilson, Ltd.	
Asquith, William, Ltd.	23
Atlantic Press, Ltd.	
Avery, W. & T., Ltd.	9
Babcock and Wilcox, Ltd.	37
Baldwin Locomotive Works	45
Bateman's Machine Tool Co.	23
Baynes, Charles	Inside Front Cover
Beanland, Perkin & Co.	5
*Beldam Packing and Rubber Co.	—
*Benn, Sykes	
Bennis, Ed., & Co., Ltd.	49
Bertrams, Ltd.	34
*Binney & Son	—
Bleichart, A., & Co.	39
Blumann & Stern, Ltd.	34
*Bolton, A., & Co.	
*Booth, Joseph & Brothers, Ltd.	
Bradbury & Co.	64
Brand, Ed	5
Brett's Patent Lifter Co., Ltd.	21
Breuer, Schumacher & Co.	14
*Bridge, David, & Co.	—
British Advertiser Service Bureau	4
*British Westinghouse Electric & Mfg. Co., Ltd.	–
Broadbent, Thos., & Sons, Ltd.	5
Broadbent, T. W.	74
*Brown, Andrew, and Co.	
Buckley, Samuel	65
*Bullivant & Co., Ltd.	–
Callender's Cable & Construction Co., Ltd.	43
*Cambridge Scientific Instrument Co., Ltd.	—
Campbell Gas Engine Co., Ltd.	4
Capell Fan Co.	74
Clarke's Crank & Forge Co., Ltd.	62
Clayton, Son & Co., Ltd.	27
Concentric Condensers, Ltd.	—
*Consolidated Pneumatic Tool Co., Ltd.	–
Cort, Arthur & Co.	29
*Crypto Electrical Co.	–
*Cundall, Son & Co., Ltd.	–
Cunliffe & Croom, Ltd.	24
Davidson & Co., Ltd.	Inside Back Cover
Davis & Primrose	21
Dean, Smith, & Grace, Ltd.	21
Deighton's Patent Flue & Tube Co., Ltd.	47

"DERBY" ROLL TOP

THE STANDARD OF COMPARISON.

[illegible] designed and finished.
Full of convenient devices other Desks have not got.

· THE DESK THAT DELIGHTS ·

Sent to your door on receipt of deposit, balance at convenience. £1

Prices from **£4 15s.,** carriage paid.

[illegible] convenience and elegance have [illegible] thousands of business and literary [illegible] convenience for saving time and worry. No lost [illegible] automatically locked up. An [illegible] to the complete furnishing of every [illegible] house.

T. INGLESANT & SONS, Ltd.,
[illegible] and Cabinet Makers by [illegible] Warrant to His Majesty the King
Atlas House, Leicester.

FREE

Write To-Day.
A Postcard now will bring you our [illegible] some Desk Catalogue. Elegantly illustrated and finished. Contains many valuable [illegible] on furnishing. Don't delay sending.

PAGE'S WEEKLY Ventilation, &c.

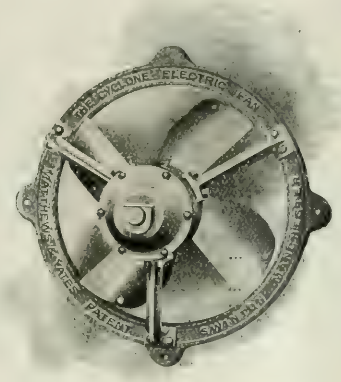
MATTHEWS & YATES, Ltd., (DEPT. G.)
Swinton, MANCHESTER.

Cyclone Fans
and
Blowers

Are not only Ventilating most of the Important Public Buildings throughout the Country, but have been adopted by the Principal Steam Ship Companies also.

BELT, ELECTRIC, & STEAM DRIVEN.

WRITE FOR CATALOGUE.



Cyclone Electric Fan. Enclosed Motor

SHONE PNEUMATIC EJECTORS

FOR RAISING SEWAGE, SLUDGE, WATER &c.

"As used for the drainage of EASTBOURNE, BOMBAY, RANGOON, SOUTHAMPTON, CAPE TOWN and many other Towns.

COMPRESSED AIR LIFTS for raising water from WELLS, BOREHOLES &c.

AIR COMPRESSING MACHINERY FOR ALL SERVICES.

HUGHES & LANCASTER
16, VICTORIA STREET, — LONDON, S.W.

Estimates & Particulars on application.

Index to Advertisers—(Contd.)

PAGE
Delange, Mce. & Cie ... 24
*Delta Metal Co. ... —
Denison, S., & Son ... 28
Dobbie-McInnes, Ltd. ... 3
Drum Engineering Co. ... 5

Ebonestos Manufacturing Co. ... 7
Eclipse Tool Manufacturing Co. ... 21
Empire Typewriter Co. ...
Enke, Carl ... 5

Fairbanks Co. ... 13
Fairley, James, & Sons ... Outside Back Cover
Farnley Iron Co., Ltd. ... 62
Fengl A., & Co. ... 3
Firth, William, Ltd. ... 45
Fleming, Birkby & Goodall, Ltd. ... 74
Fowler, John, & Co. (Leeds), Ltd. ... 44
Fraser & Chalmers, Ltd.... ...

*Gent & Co., Ltd. ...
Gibbs, John, & Son ...
Gilmour, W. & O. ... 40
Glover, M., & Co. ... 24
Grantham Boiler and Crank Co., Ltd. ... [illegible]
Green, E., & Son, Ltd. ... Inside Back Cover
Greenwood & Batley, Ltd. ... 58
Griffin, Charles & Co., Ltd. ... 13

Hagans Locomotive Works ... 3
Halden, J., & Co. ... 67
*Hall, B. J., & Co. ...
Hall, J. P., & Sons, Ltd.... 54

PAGE
*Hannan & Buchanan ... —
Hartley & Sugden, Ltd. ... 4
Hasenclever Söhne, C. W. ... Inside Front Cover
Hathorn, Davey & Co., Ltd. ... 11
Head, Wrightson & Co., Ltd. ... 69
Heenan and Froude, Ltd. ... 5
Hepton, W., & Sons ... 40
*Holmes, W. C., & Co. ... —
*Hopkinson, J., & Co., Ltd. ...
Horsfall Destructor Co. ... 70
Howard Bros. ... 71
Howes, S., & Co. ... 31
Hudswell, Clarke & Co., Ltd. ... 42
Hughes & Lancaster ... 36
Hughes, G. H. ... 3
Hunslet Engine Co. ... 45
*Hunt & Mitton ... —
Hyatt Roller Bearing Co. ... 13

India Rubber, Gutta Percha, and Telegraph Works Co., Ltd. ... Outside Back Cover
Inglesant, T., & Sons, Ltd. ... 35

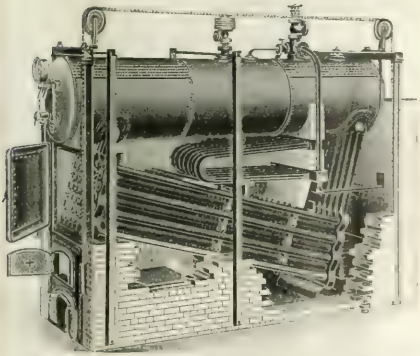
Jones & Lamson Machine Co. ... 3

Keep, Juxon & Co. ... 54
Krupp, Fried. ... 39

Lancaster & Tonge, Ltd. ... 28
Lang, John, & Sons ... 22
*Lassen & Hjort ...
Leckenby, Benton & Co. ...
Leeds Forge Co., Ltd. ... 47
Lepard & Smiths, Ltd. ... 68

BABCOCK & WILCOX Ltd., Engineers and Manufacturers of

Patent Water-Tube Boilers.



BABCOCK & WILCOX BOILER FITTED WITH SUPERHEATER.

OVER 4,900,000 H.P. IN USE IN ALL INDUSTRIES.

The only Water-Tube Boiler which gained the GRAND PRIX (Highest Award) at the Paris International Exhibition, 1900.

Complete Installations of Steam Piping and Boiler House Plants.

ALSO

WATER-TUBE MARINE BOILERS.

ESTIMATES AND PLANS ON APPLICATION.

Head Offices

LONDON: Oriel House, Farringdon St., E.C.; and Branches.

A valuable treatise on "Steam" and "Accessories" Catalogue free on application to Engineers and Steam Users.

WORKS: RENFREW, SCOTLAND.

Index to Advertisers—(Contd.)

PAGE
Luke and Spencer, Ltd. 16
Lyle Co., Ltd. 60

Mabic, Todd & Bard ... ... —
McLaren, J. and H. 45
McTear & Co., Ltd. 53
*Magnesia Coverings Ltd. ... ... —
Magnolia Anti-Friction Metal Co., Ltd. 41
Mailmann, P. J. 48, 56
Marion & Co., Ltd. ... ... Outside Back Cover
Matthews & Yates, Ltd 36
Melling, J. F. 4
Melville & Macalpine 3
Miller, Hy., & Co. 42
Mirrlees Watson Co., Ltd. 46
Mitchell, D., & Co., Ltd. 18
Mix & Genest 58
Mount-Haes, A. 3

Nalder Bros., & Thompson ... ... —
New Gutta Percha Co., Ltd. ... ...
New Zealand Mines Record ... ... —
Newton Bros. 58
*Nicholson Tool Co. ... ... —
Niles-Bement-Pond Co. 16
Noble & Lund, Ltd. 17
Northern Engineering Co., 1900, Ltd.... 20
Northern Railway of France 72

Page & Rowlingson 3
*Parker Foundry Co. ... ...
Parkinson, J., & Son 18
Pegg, S., & Son 47
Periam, H. W., Ltd. 66
Phœnix Dynamo Mfg. Co. 56
Phosphor Bronze Co., Ltd. 27
Piggott, Thos., & Co., Ltd. 62
Positive Rotary Pumps, Ltd. ... ...
Pratt & Whitney Co. ... ... —
Pryor, Edward, & Son 3
*Purden & Son, John ... ... —

*Quaker City Rubber Co. ... ...

Recorders, Ltd. 70
*Redfern, S., & Co. ... ... —
Redman, C., & Sons 18
Reid Gear Co. ... ... Inside Front Cover
*Reliance Lubricating Oil Co. ... ... —
Rice & Co. (Leeds), Ltd... 20
*Richardsons, Westgarth & Co., Ltd. ... ...
Richter, Gustav 56
Riter-Conley Mfg. Co. 64
Robinson, T. D. & Co., Ltd. 65
Rockwell-Wabash Co., Ltd. 33
Roller, A. ... ... Inside Front Cover
Rose, Downs & Thompson, Ltd. 34
Rubber Stamp Co. 66

*Samson & Co. ... ... —
Sankey, J. H., & Son 34
Schieren, Chas. A. & Co. 32
Schnicke, H. F. 64
Scotch & Irish Oxygen Co., Ltd. 5
*Scott, E., and Mountain, Ltd. ... ...
Scott, Walter, Ltd. 64

SOMETHING NEW.

How to deal with Inward Invoices.

Does your present system involve the looking through a mass of detail before arriving at any required invoice?
If it does, then you are wasting your time.

YOU CANNOT AFFORD TO DO THIS.

THINK OF THE SAVING

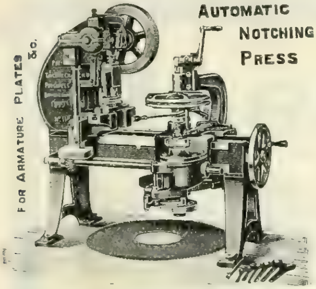
if you adopt a system that will enable you to find any required invoice at once.

YOU OUGHT TO KNOW SOMETHING ABOUT THIS.

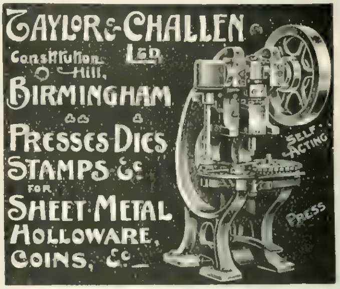
PARTICULARS OF

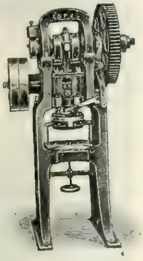
The Trading & Manufacturing Co., Ltd.,
C.I. DEPT.,
27 & 28, FLEET STREET, LONDON, E.C.

PAGE'S WEEKLY Miscellaneous



Automatic Notching Press





Drawing Press.

Iron and Steel Rolling Mills.

Cogging Mills, Plate Mills for Armour Plates, Heavy and Fine Plates, Plants for the Manufacture of Tinned Sheet Iron, Girder and Rail Mills. Merchant Bar, Wire and Hoop Mills, Rolling Mills for Billets, Slabs and Sheet Bars, Pipe Mills, Universal and Special Mills.

Live Roller Trains and Troughs, Saws, Shearing Machines, Presses, &c.

FRIED. KRUPP A.-G. GRUSONWERK, Magdeburg-Buckau.

Sole Representative for Great Britain and Ireland : W. STAMM, 25, College Hill, Cannon Street, LONDON, E.C.

THE . . .

PACKING

OF PACKINGS.

THE FIRST
SUCCESSFUL AUTOMATIC
METALLIC PACKING . . .
AND STILL **THE BEST.**

OVER 160,000 IN SERVICE.

USED BY BRITISH, UNITED STATES, DUTCH, JAPANESE, SPANISH, &c NAVIES.

Index to Advertisers—(Contd.)

PAGE
Shannon, Ltd ... 69
Shaw, Joseph ... 5
Smith, G. F., Ltd.... 18
Smith, Thomas & Sons, of Saltley, Ltd. ... 61
South Eastern & Chatham Ry. ... 72
Spon, E. & F. N ... 3
Spottiswoode & Co., Ltd. ... —
Stafford, A., & Co. ... 73
Stamm, W. ... 30
Stirling Boiler Co., Ltd. ... 51
Suddeutsche Kabelwerke, A. G. ... 4
Summerscales, W., & Sons, Ltd. ... 29
Swain, John & Son, Ltd.... 73
*Swift, George ... —

Taylor & Challen, Ltd. ... 30
Temperley Transporter Co. ... 31
Thom, John Z. ... 55
Thompson, John ... 4
*Thornycroft, John I., & Co., Ltd. ... —
Tomey, J., & Son ... 4
Trading and Manufacturing Co., Ltd. ... 38
*Treasure, J. B., & Co. ... —
Tubes, Ltd. ... 52
Turner, Atherton & Co. ... 50

United States Metallic Packing Co., Ltd. ... 30

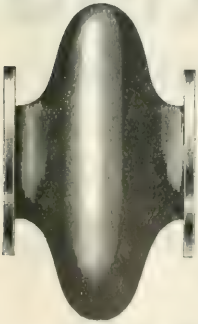
PAGE
Valor Co., Ltd. ... 29
Vauxhall and West Hydraulic Engineering Co., Ltd 15
*Von der Heyde, J. Bennett ... —

Ward, H. W., & Co. ... 10
Ward, T. W. ... 37
Waygood & Co., Ltd. ... 69
Weaver, B., & Co ... 3
Weise & Monski ... 54
*Wells, A. C., & Co. ... —
*Wells & Co., M. ... —
West & Co., H. J. ... 43
West Hydraulic Engineering Co. ... 15
Westinghouse Elec. & Mfg. Co. (British) ... —
West Pascagoula Creosoting Works ... 5
Wild, M. B., & Co ... 25
Williams, J. H., & Co. ... 66
Winn, Charles, & Co. ... 51
Woodhouse & Rixson ... 65
"Woodite" Co. ... 59
Wrigley, E. G., & Co., Ltd. ... 42

Yorkshire Patent Steam Wagon Co. ... —
Yorkshire Machine Tool and Engineering Works 10

*Yost Typewriter Co. ... —

Zeitz & Co.... 5



HEPTON & SONS,
LEEDS,
Makers of
Copper and
Brass Work
Of every description for
Engineers and
Colliery Owners.

SPECIAL COPPER EXPANSION JOINT,
SEAMLESS ANY DIAMETER.
Particulars and Prices on Application.

W. & O. GILMOUR,
Machine Belt Manufacturers,
St. John's Hill,
EDINBURGH.
Telegrams: "BELTING, EDINBURGH." Telephone No.: 575 Central

Belting
MADE FROM
PURE OAK TANNED
LEATHER.

Quality is Our First Consideration.

[illegible] **Eighty Years** we have been makers of [illegible] Belting, but owing to the [illegible] demands of trade [illegible] just [illegible] down [illegible], and are now in [illegible] to supply Oak Tanned Leather Belting at [illegible] a price as is [illegible] with first-class goods.

MAGNOLIA METAL..

Best Anti-Friction Metal for all Machinery Bearings.

MAGNOLIA ANTI-FRICTION METAL
MAGNOLIA ANTI-FRICTION METAL
MAGNOLIA ANTI-FRICTION METAL

"Flower" Brand.

TO PREVENT IMPOSTURE, SPECIFY "MAGNOLIA METAL, FLOWER BRAND."

BEWARE OF IMITATIONS! GENUINE ORIGINAL METAL ALWAYS IN THIS FORM OF INGOT.

'Flower" Brand.

The Name and Trade Mark appear on each Box and Ingot.

Magnolia Anti-Friction Metal Company, of Great Britain, Limited,

49, QUEEN VICTORIA STREET,
LONDON, E.C.

Telephone: 5925 Bank Telegrams: 'MAGNOLIER, LONDON.'

BERLIN: FRIEDRICH STRASSE, 71. PARIS: 50, RUE TAITBOUT.
LIEGE, BELGIUM: 36 RUE DE L'UNIVERSITE.
GENOA, VIA SOTTORIPA 1, PIANO NOBILE.

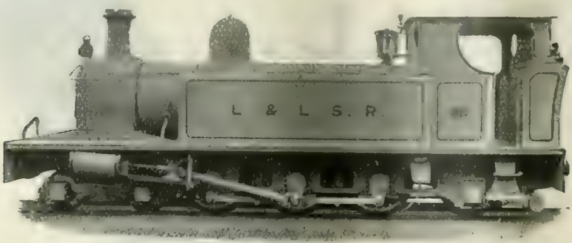
PAGE'S WEEKLY Miscellaneous

ESTABLISHED 1860. TEL. ADDRESS: "LOCO., LEEDS."

HUDSWELL, CLARKE & Co., LTD.,
RAILWAY FOUNDRY LEEDS.

LOCOMOTIVE ENGINES,

Of all sizes and any gauge of Railway, of greatly improved Construction, for Main or Branch Railways, Contractors, Ironworks, Collieries. Prices, Photographs, and full Specifications on application.



SOLE MAKERS OF THE "RODGERS" PULLEYS (Registered).
Wrought Iron throughout, Rim, Arms, and Boss.
ALSO "ETCHELLS'" NON-DRIP BEARINGS, SHAFTING, AND ACCESSORIES.

For full particulars write:—
Hy. MILLER & CO.

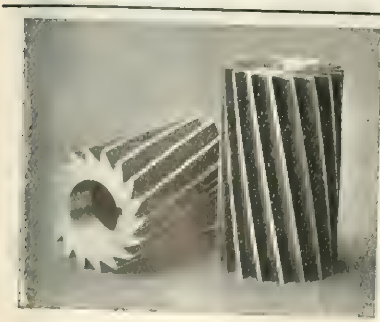
USE
STEELENE
FOR
CASE-HARDENING.

Millgarth Works,
LEEDS.

MILLING CUTTERS.

High Speed
or
Ordinary Steel.

E. G. WRIGLEY & CO., Ltd.,
Foundry Lane Works,
SOHO, BIRMINGHAM.



PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VII. LONDON, FRIDAY, NOVEMBER 24, 1905. No. 63.

The Offices of "Page's Weekly," Wednesday Evening.

ELECTRIC power schemes for London continue to tread upon each other's heels. Attention was directed in the last issue to the salient features of the different proposals which have been put forward. The more important schemes at the time comment was made upon the position last week were the Administrative County of London, with which Mr. Merz is associated, and that of the London County Council, the latter, in the opinion of many critics, a leap in the dark. The representatives of the borough councils have since been conferred with, and have approved of the Spring Gardens programme, within certain limits. They desire that provision should be made to safeguard the interests of the borough councils' existing undertakings, and there is a veritable omnibus reservation, that their approval is subject to the details of the measures proving to be "otherwise satisfactory." As a matter of fact, the representatives of the borough councils have pledged themselves to nothing. The conditions laid down will permit them giving the County Council Bill their uncompromising opposition, should they be so minded.

The latest power scheme is a private undertaking. Authority is to be sought this year for the erection of a large power station at St. Neots, on the River Ouse, from which electrical energy is to be transmitted to London for the supply in bulk to existing electricity supply companies and borough councils, and for the running of railways. Current is to be conveyed from St. Neots to Enfield, a distance of forty miles, along a private right of way adjacent to the Great Northern Railway

[illegible]

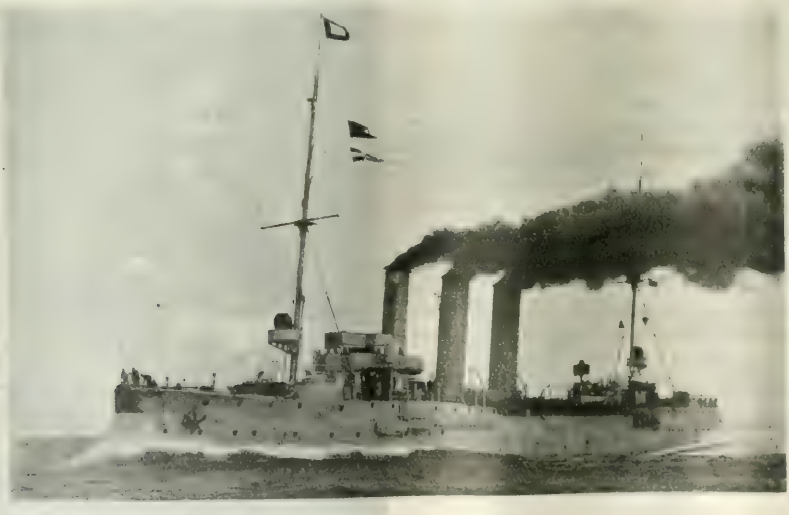
PROFESSOR J. A. FLEMING, D.SC., F.R.S.,
Who will deliver the first of a series of Cantor lectures dealing with the measurement of high frequency currents and electric waves on Monday.

line. From Enfield to London the transmission will be underground. Electrical energy will be supplied in London at ½d. per unit. It is estimated that the cost, inclusive of thirty miles of distributors, will not exceed £2,000,000.

The promoters are largely relying on cheap coal for the realisation of the ½d. per unit ideal. It is stated that the present distributors are not to be interfered with, but the view of the present vendors of electric power is likely to prove quite another story. The fight for the right to exploit London with regard to electric power supply is going to be a tough business. The consumer will probably come out of the struggle on top.

— —

There is an astonishing variation in trade calendars. In some cases one has to hunt for the date, and occasionally a really hideous monstrosity is perpetrated in which it is necessary to hunt for the calendar, too. We have seen productions so lacking in taste that the recipients have been glad to hide them behind desks or in cupboards. Granted that gifts should not be received in an over-critical spirit, it is not too much, we think, to ask of the designer that, as his calendar is to be looked at daily, it should be pleasing to the eye and effective in arrangement. It is possible to send out a square yard of unattractive advertising material combined with a two-inch panel for dates, but will the recipients hang the calendar, so-called, or mentally apostrophise and "hang" the sender? If its essential object is subordinated to other matters, a calendar loses force as a reminder both of dates and of people.



[illegible]

THE GERMAN TURBINE CRUISER "LÜBECK."

The *Lübeck* is a small third-class cruiser of 3,200 tons displacement. She is interesting as the first German cruiser to be fitted with turbine machinery. There are two shafts on each side, each driven by a high and low pressure turbine. Steam is generated by Schulz-Thornycroft boilers, the i.h.p. being 11,000. She carries 10 4·1 in. q.f. guns, 10 1·45 in. q.f., and 4 [illegible] machine guns. Two torpedo tubes (submerged) are provided for 18 in. torpedoes. The German Naval Bill for 1906, approved by the Federal Council last week, adds five large cruisers to the foreign service and one to the reserve. Eight divisions of torpedo-boats are to be added to the sixteen provided for.

In his address to the Society of Arts on Wednesday, Sir Owen Roberts made some observations on the subject of technical education and industrial conditions which are worth more than passing notice. He points out that to succeed under the conditions in which modern industry has to be carried on, a nation must be educated with a primary regard to those conditions. For England this is a question of life or death. Technical education itself is not enough. The dangers which lie ahead as regards our national prosperity spring mainly, thinks Sir Owen Roberts, from two sources: the new impatience of the teachings of political economy, and the disinclination to study the bearing and influence of foreign and colonial affairs on material interests at home. The great enfranchised democracy will never feel a real interest in foreign affairs until they understand, as they can be made to understand, that this is a Saturday night's wages question. Constantinople, Egypt and India, will soon become interesting enough if it can be realised that the smoke from Lancashire, Yorkshire and Staffordshire chimneys depends largely on a prudent and patriotic conduct of our foreign and colonial relations, which ought to be removed from the domain of party politics. There is food for thought in this view of the importance of technical education.

The congeries of isolated Technical Institutions at South Kensignton include the Central Technical College of the City Guilds and the Royal College of Science. There seems now to be a fair prospect of "crowning the edifice" of technical education, which has, owing to the English policy of "muddling through" somehow, been laboriously growing up without much coherence or system. It is proposed to create the new institution at South Kensington for the teaching of science and technology, where the very highest courses of specialised instruction shall be given, with facilities for the most advanced training and research in the various branches of science as applied or applicable to the arts and industries of the Empire. This can be done by placing the now existing institutions, together with other buildings in course of construction at South Kensington, under some common form of government, and it will be necessary to combine the work of the Royal College of Science (including the School of Mines) and of the Central Technical College as parts of one organised whole.

The Government have, says Sir Owen Roberts, agreed to co-operate in this scheme to the fullest extent, and so have the governing authorities of the Central Technical College of the City Guilds, with some minor reservations necessary to preserve their modified autonomy as well as their own personal identity and continuity. In so doing, the City Guilds will again have shown their willingness to subordinate their own legitimate functions and authority connected with technical education to national requirements and exigencies. They will doubtless also have secured to themselves a great influence and adequate representation on the governing body to be created for the co-ordination of the several institutions in being and in projected so as to bring about the fulfilment of the great scheme and ideals placed before the country by Lord Rosebery and Mr. Haldane. The co-operation of the London County Council, scarcely less important than that of the Government itself, has also been secured, and it is anticipated that very large amounts of capital and adequate endowments will become available for the maintenance of the new "Charlottenburg," as it has been rather unhappily called.

Sir Benjamin Baker, in his report on the widening of Blackfriars-bridge, recommends that the structure be widened 30 ft. on the western side, and that new foundations be placed in the river to carry the increased weight, the reconstruction being considered absolutely necessary. Application is intended to be made to Parliament in the ensuing Session by the Corporation of London to empower them to widen the bridge accordingly, commencing at or near the northern abutment and terminating at or near the top of the stairs at the south-western end; also to construct a tramway (double line) about one furlong 9·5 chains in length on the Victoria Embankment, about four chains east from a point opposite John Carpenter Street, passing thence over Blackfriars Bridge and terminating in Christ Church, Southwark.

Lord Harris, presiding at the ordinary general meeting of the Consolidated Goldfields of South Africa, Ltd., remarked that the gold-mining industry had never been on so secure and sound a commercial basis as it was at that moment. He believed that they were going to see a gradual, possibly, but still a continuance of progress in the reduction of working costs, and the effect of improvements in economical management, and economical working of the ore bodies. In this country, however, we were very impatient. For instance, last year he remembered quite a flutter of excitement about tube mills. Their economic utility had not been proved, but the information about them was considered good enough to warrant rising prices. Now, however, that it could be shown that tube mills, where the grade of ore was suitable, actually resulted in a saving, as in the Robinson Deep, of as much as 4s. a ton nobody took any notice of the point. Economy of this kind would, however, have its effect, and when it was helped by economy in another direction as Mr. Webb (the consuting engineer) unmistakably showed in the case, for instance, of the Sumner and Jack the possibilities of the future were bound to be recognised. It may be added that there is every indication that the Rand gold output for 1905 will approximate to [illegible].

Discussing the relative efficiencies of tube mills and grinding pans, in a recent issue of the Mining Magazine, Messrs. G. A. and H. S. Denny remark that: "For regrinding the tube mill was recommended for the first time on these fields by the writers, and since that time much has been heard of this machine. There is in the minds of the writers, however —in the light of the experience they have gained of tube mills and with their knowledge of the excellent work which can be done with pans of the Wheeler type, gained from West Australian practice—a growing doubt as to whether the tube mill is really the best machine to employ for this classs of work, since for our purposes complete sliming is not required. Considerable attention has lately been devoted to the use of grinding pans in West Australia, and the result of comparisons extending over a considerable period has shown that there are certain advantages to be gained by the use of pans which apparently place them in advance of the tube mill for our particular requirements. In our own investigations on reground products, it was found that even with clean concentrates a very considerable extraction could be obtained by passing them over plates after being re-ground, and the same feature was found to obtain with the reground sands. The tube mill is not the kind of machine in which one would care to resort to amalgamation, firstly, because the operator cannot see what is taking place in the mill, and secondly, because the flints would have a decided tendency to flour the mercury. The grinding pan, on the contrary, has been well-known as an amalgamator for many years. It is accessible and easily under control of the operator at any time, and the writers are of opinion that on reground products from Witwatersrand ores its qualities as an amalgamating machines are of the very greatest importance. Not only this but the grinding pan is an easily handled unit, whereas the tube mill is not."

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.
Telephone No. 5349 GERRARD.
Telegraphic and Cable Address: "SINEWY, LONDON."

Correspondence *is invited from any person upon subjects of interest to the engineering community. In all cases this must be accompanied by full name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

The Editor does not hold himself responsible for the opinions expressed by individual contributors, nor does he necessarily identify himself with their views.

Subscription Rates per Year.

Post free to any part of the world—In advance, 20s. for twelve months.

Sample Copies: United Kingdom, 6d., post free; Abroad, 8½d. post free.

Remittances should be made payable to PAGE'S WEEKLY and may be forwarded by Cheque, Money Order, Draft, Post Office Orders or Registered Letter. Cheques should be crossed "LONDON & COUNTY BANK, Covent Garden Branch." P.O.'s and P.O.O.'s to be made payable at East Strand Post Office, London, W.C. When a change of address is notified, both the new and old addresses should be given. All orders must be accompanied by remittance, and no subscription will be continued after expiration unless by special arrangement. Subscribers are requested to give information of any irregularity in receiving the Weekly.

When Foreign Subscriptions are sent by Post Office Orders advice should be sent to the Publisher.

Foreign and Colonial Subscribers receiving incomplete copies through newsagents, are requested to communicate the fact to the Publisher, together with the agent's name and address.

New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

The whole of the contents of this journal are copyright, and full rights are reserved.

MEETINGS, ETC., FOR THE ENSUING WEEK.

FRIDAY, Nov. 24.—Conference of Glow Lamp Manufacturers: Institution of Civil Engineers 11 a.m.—Physical Society: Royal College of Science, 5 p.m.

SATURDAY, Nov. 25.—North of England Institute of Mining and Mechanical Engineers.

MONDAY, Nov. 27.—Institute of Marine Engineers: Paper, "Decimal and Metre Systems," Mr. F. Cooper.

TUESDAY, Nov. 28.—Institution of Civil Engineers 8 p.m.: Continued discussion on Mr. Saner's Paper, "Waterways of Great Britain." Paper, Hon. C. A. Parsons, on [illegible]. Institution of Electrical Engineers (Manchester Local Section).

WEDNESDAY, Nov. 29.—Liverpool Engineering Society: Paper, "The Salvage of Ships," by Mr. F. W. Young.

THURSDAY, Nov. 30.—Royal Society: Presidential address by Lord Rayleigh.—Rugby Engineering Society: Paper, "Conversion of Steam Energy into Electrical Energy," Messrs. [illegible] and Reynolds.

NEWS ITEMS.

The armoured cruiser *Warrior* to be launched at Pembroke on Saturday is the last of the *Duke of Edinburgh* class to enter the water.

According to a recent report the length of steam railways in the United States on December 31st 1904, was [illegible] miles, a net increase of 5,014 miles in the year.

Messrs. Vickers, Sons and Maxim have obtained a contract to construct a floating dock for submarines. The dock is to cost £30,500 and is to be delivered at Haslar Creek.

The promoters of the proposed light railway from Bournemouth to Swanage have, it is stated, decided to proceed with their scheme, which is estimated to cost £[illegible].

It is stated that Parliamentary powers are to be sought next session for a new South Lancashire railway to tap the hitherto undeveloped agricultural portions of the Fylde and to link them with the Midland system at Lancaster.

Electric traction is to be employed from the outset in the Simplon Tunnel, and according to the *Temps* an agreement has been signed with a Swiss firm by which the necessary installation is to be completed by May 1, the date on which the tunnel is to be opened.

In view of the many difficulties involved in the standardization of carbon filament glow lamps, a conference of makers is being called to-day by the Sub-Committee on Physical Standards of the Engineering Standards Committee, prior to formulating recommendations for the Electrical Plant Committee.

CONTENTS.

PAGE
[illegible] Notes (Illustrated) [illegible]
News Items (Illustrated) [illegible]
[illegible] Manganese Car[illegible] Second Report of the [illegible] Research Committee (Illustrated) [illegible]
Technical Society Notes [illegible]
[illegible] Notes [illegible]
[illegible] High-speed [illegible] By J. M. Gledhill (Illustrated) [illegible]
[illegible] [illegible]
[illegible] Biography [illegible] [illegible]

PAGE
New Model 7 ft. "Niles" Universal Radial Drilling Machine. By the Niles-Bement-Pond Company. (Illustrated) ... 1158
Electrical Power Supply in Mines. By A. Spies (Illustrated) ... 1160
International Motor Exhibition at Olympia ... 1170
The Technical Library (Electrical Works) ... 1175
Contractors' News ... 1177
Share List ... 1179
Home Metal Market (Chart) ... 1182
Prices Current ... 1183
Selected Patents ... 1188
New Publications ... 1190
New Catalogues ... 1190

Fire-proof Construction.

The terrible outbreak of fire in a lodging house at Glasgow will doubtless result in an increased demand for fire-proof material. The same post which brings details of the disaster includes also a very suggestive and instructive account of some tests which have lately been carried out by the British Fire Prevention Committee.

One of these relates to a 2½-in. partition formed with 2⅛-in. porous terra-cotta hollow tiles, erected by the National Fireproofing Company, of Pittsburg and London.

The test indicates that it is possible to provide partitions 2½ in. thick (2⅛ in. slabs and ⅜ in. plastering), having a length of 10 ft. and a height of 8 ft. 10 in. that will prevent the passage of flame and smoke from a fire burning for two and a half hours on the plastered side of the partition, raising the temperature to 1,980 deg. F. (1,082·2 deg. C.) and then prevent the passage of water from a steam fire engine jet.

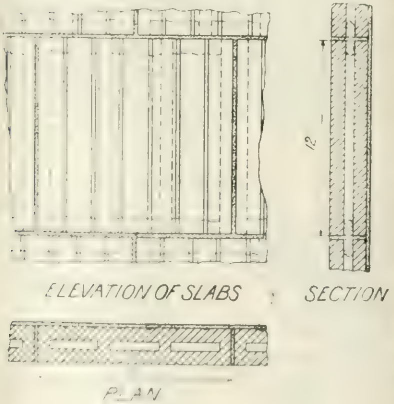
The object of the test was to record the effect of a fire of the duration mentioned with a gradually increasing temperature to 1,800 deg. F. (982·2 deg. C.), but not exceeding 2,000 deg. F. (1,093·3 deg. C.), followed by the application of water on the fire side for two minutes with a view to classification as affording "Full Protection" (Class A) of the standard table for fire-resisting partitions. The partition, in compliance with the requirements of the above class, to have an area of at least 80 ft. superficial (7·43 square meters) with a thickness not exceeding 2½ in. (·063 meters) when finished. The time allowed for drying the partitions was twenty-five days (summer).

The summary of effect states that during the first five minutes the finishing coat of plaster towards the fire flaked off; the first coat remained in position until water was applied, when most of it was washed away. In twenty minutes one vertical and one horizontal crack appeared on the surface of the partition away from the fire, increasing to nearly the whole height and length of the partition.

Shorter cracks also appeared from the floor level to each side wall at angles of about 45 deg.; a similar crack also appeared at the south-east angle from ceiling to side wall. All these cracks slightly increased in length and width during the test. The cracks passed along the joints and beds and also across the tiles.

The partition bulged towards the fire the maximum at the centre being 2¼ in. (·057 meter); at the conclusion of the test the bulging was reduced to 2 in. (·0508 meter). The face of one tile on the fire side split off. Neither fire, smoke, nor water passed through the partition itself, which remained in position at the conclusion of test.

The tiles were each 12 in. by 12 in., and each contained three perforations 3 in. long by [illegible] in. wide. The weight of the tile was from 12 to 12[illegible] lb. The partition consisted of eight full courses and a filling course about 6 in. deep. In construction the tiles were soaked in water and built on a course of stock bricks resting on the floor of the hut, up to the underside of the solid ceiling of wood and plaster, and between walls of the testing chamber, cement mortar composed of one part of cement to two parts of sand being used for the beds and joints, and the mortar in the beds forming dowels in the vertical perforations. The partition was plastered in two coats on the fire side with mortar containing a handful of hair and a bushel of asbestos to one yard of clean sand and half a yard of grey lime.



[illegible] OF FIRE-PROOF TILES.

Annual Dinner

The foremen employed at the Wellington Works of Messrs. Bradbury and Co., Ltd., Oldham, recently held a very successful annual dinner and "smoker" at the Friendship Hotel, Oldham. Mr. [illegible] Howarth (general manager) presided, and in his [illegible] remarks referred to the greatly improved prospects of the company. With the present staff of [illegible] foremen and a continuance of the friendly [illegible] existing among the managers and foremen he was sure that when they next sat down to dinner together they would have to report a very steady progress. [illegible] Lumley proposed the toast of [illegible] Bradbury [illegible]," and the toast of "the [illegible]" was proposed by Mr. J. S. Marland.

Natal Coal Tests.

Mr. W. J. Quince favours us with a copy of the elaborate report which has been issued by the Natal Coal Testing Committee. Representations having been made to the Natal Government by some of the colliery owners of the desirability of having a series of tests of Natal coal made, other than the locomotive tests made by the Railway department, a committee consisting of the Commissioner of Mines, the Locomotive Superintendent, N.G.R., and the Inspector of Boilers, was appointed to carry out an independent series in order to determine the relative speeds of burning of the various coals under given circumstances, and the relative efficiencies of the same coal at different speeds of burning.

The boilers provided at the testing station were a Reid locomotive boiler and a Marshall portable boiler which have very different ratios of heating surface to grate area. Four tests of each coal in each boiler i.e., eight tests were made :—viz., eight hours ordinary draught, seven hours light draught, six hours medium draught, four hours full draught.

It is pointed out that the results given in the report represent the character of each coal at the time of test only, there being no certainty that at the time the report was sent in, the coal from a particular colliery was not of slightly better or worse quality owing for example to increased or decreased care in cleaning on the picking belts.

For the purpose of rendering the results available for rough comparison with results obtained elsewhere with other coals a quantity of Welsh coal (Nixon's navigation double screened) was purchased from the Union Castle Steamship Company.

The efficiencies of the various coals varied in the tests made with the strengths of draught and corresponding speeds of burning. The relative results deduced from the equivalent evaporations (Reid boiler), fully corrected, are shown in the accompanying table. For much interesting additional information concerning Natal coals, we must refer our readers to the report, which is printed by P. Davis and Sons, Maritzburg.

* * *

Mr. Herbert A. Evans, M.Inst.M.M., has been appointed superintendent of the mines of the Tolima Mining Company Ltd., in Columbia, South America, as from June 1st last.

Mr. R. H. Goodwin, M.Inst.M.M., left London on September 30th for British Guiana to resume work as resident engineer to the British Guiana Consolidated Gold Mines.

	Natural Draught.		Light Draught.		Medium Draught.		Full Draught.	
Outputting Collieries and Welsh.	Nixon's Navigation (Welsh)	1·21	Nixon's Navigation (Welsh)	1·20	Nixon's Navigation (Welsh)	1·19	Nixon's Navigation (Welsh)	1·205
	Elandslaagte	1·09	St. George's	1·05	Natal Navigation	1·035	Natal Navigation	1·04
	St. George's	1·08	Natal Navigation	1·04	Elandslaagte	1·03	St. George's	1·04
	Zululand (b)	1·07	Glencoe	1·03	St. George's	1·02	Glencoe	1·02
	Dundee No. 6	1·06	Dundee No. 6	1·02	Glencoe	1·01	Elandslaagte	1·00
	Natal Steam	1·01	Dundee No. 4	1·01	Dundee No. 6	1·01	Average Coal	1·00
	Dundee No. 4	1·00	Elandslaagte	1·00	Dundee No. 4	1·01	Dundee No. 4	1·00
	Average Coal	1·00	Average Coal	1·00	Average Coal	1·00	Durban Navigation	1·00
	Zululand (a)	1·00	No. 42	·97	Natal Steam	·96	Dundee No. 6	·97
	Natal Navigation	·97	Durban Navigation	·96	Durban Navigation	·96	West Lennoxton	·96
	Glencoe	·965	Natal Steam	·95	West Lennoxton	·945	Ramsays	·95
	Durban Navigation	·96	West Lennoxton	·94	No. 42	·944	No. 42	·95
	No. 42	·945	Ramsays	·91	Ramsays	·92	Natal Steam	·92
	Ramsays	·88	Newcastle	·87	Newcastle	·89	Newcastle	·92
	Newcastle	·85	Zululand	·85	Zululand	·81	Zululand	·88
	West Lennoxton	·83			Zululand (a)	·79		
	Zululand	·73						
Non-outputting Collieries, &c.	Makatese Kop	1·18	Makatese Kop	1·135	Makatese Kop	1·11	Makatese Kop	1·09
	Elandslaagte (bottom)	1·12	Vaalbank	1·085	Natal Merthyr	1·025	Vaalbank	1·04
	Natal Merthyr	1·07	Impati	1·05	Central	·98	Natal Merthyr	1·01
	Utrecht	1·02	Natal Merthyr	1·02	Utrecht	·97	Central	·99
	Central	·94	Vrede	[illegible]	Elandslaagte (bottom)	·94	Utrecht	·98
			Central	·99			Vrede	·945
			Utrecht	·98			Elandslaagte (bottom)	·93
			Elandslaagte (bottom)	·975			Newcastle Steam	·86
			Newcastle Steam	·935				

NATAL COAL EFFICIENCIES.

British Coal for Russia.

The British Commercial Agent in Russia (Mr. Henry Cooke) quotes from the Commercial and Industrial Gazette of St. Petersburg to the effect that an unprecedently large import of British coal is expected this autumn and winter *via* Reval, for, in addition to the orders for local works and factories, the Baltic and Pskoff railways have ordered through two St. Petersburg import firms 3,000,000 pouds (about 48,000 tons) to be dispatched *via* Reval.

South African Mining Progress.

The report of the directors of the British South Africa Company states that the progress of the mining industry during the year ended March 31st, 1905, was far more rapid, solid and satisfactory than during any similar period since the formation of the company, and the improvement has been even more marked since the above date. A most satisfactory feature of this progress has been the rapid and continuous increase in the number of individuals and small syndicates who are now engaged in the profitable working of properties upon a small scale. It is believed that the number of reefs in Rhodesia which can be profitably worked in this way on a small scale is very large, and the Administrator has been authorised to advance limited sums on security to approved persons to assist them to erect the necessary machinery.

Metallurgical Lecture at Birmingham.

Mr. J. F. Stansbie, F.I.C., has just contributed an interesting paper to the Metallurgical Society at the Birmingham Municipal Technical School, on "Solutions of Solids and Solid Solutions." The author deals with a question of considerable importance to the metallurgist. It has been stated that solid solutions in the case of metals are heterogeneous on account of the slow diffusion which takes place in the molten metals as compared with the solutions of solids in liquids. But it would appear that this is only a matter of time; for if the alloy is kept molten sufficiently long, uniform concentration may be attained, and then the slow motions of the components in the solution would favour the retention of uniform concentration in the alloy on freezing.

But another aspect of the question arises when chemical compounds are formed between the metals, or a metal and a non-metal. In this case any solution must be formed by the dissolution of the compound in excess of the main mass of the metal. A case in point is found in the alloys of copper and arsenic. There is not the slightest doubt but that arsenide of copper is formed and dissolved in the molten alloy. Micro-examination of copper-arsenic alloys shows that a separation takes place during the solidification. But it is probable that a certain percentage of arsenic in the arsenide forms a solid solution, which has a much less hurtful effect on the main mass of the metal than when an eutectic separates. This is a practical question of some importance to those who introduce small percentages of certain elements into copper to produce sound castings. For it is clear that the proportion of the added element should be about that required to form the solid solution, and this for arsenic in copper seems to be about 0·25 per cent. of arsenic.

It is expected that the work in connection with the construction of a new bridge across the Wear, joining Sunderland with Southwick, will be put in hand immediately. The total cost, it is estimated, will be £300,000.

At the opening of the first section of the Shanghai-Nanking Railway, the first train proceeded to Naziang, a distance of twelve miles, conveying the principal Chinese officials and foreign residents. Work on the railway is proceeding vigorously.

The first section of the Keyham extension works, consisting of the tidal basin, was opened on Monday by the admission of sea-water through ten sluices in the cofferdam. The works comprise two basins and four docks, enclosed in the area of 114 acres, and over six millions have been spent up to date.

OBITUARY NOTICES.

The death is announced of Mr. John Henry Wurtzburg, a director of Greenwood and Batley, Ltd. Mr. Wurtzburg, who has been ill a few days only, was for six years up to November last an Alderman of Leeds. He was chairman of the old Leeds School Board and became chairman of the new education committee of the town council, continuing in that office until November last. He had been president of the Leeds Chamber of Commerce.

The death is announced of Mr. William Henry Greenwood, formerly professor of metallurgy at Sheffield. He was the author of a manual of metallurgy and a treatise on steel and iron, and received the Watt medal for a paper on the treatment of steel read before the Institution of Civil Engineers. He was educated at the Royal School of Mines, and subsequently was chief engineer of the St. Petersburg Ordnance works. Since 1889 he was general manager of the Birmingham Metal and Munitions Company, Ltd. He was a member of the Iron and Steel Institute.

IRON-NICKEL-MANGANESE CARBON ALLOYS.

SEVENTH REPORT TO ALLOYS RESEARCH COMMITTEE.

By H. C. H. Carpenter, R. A. Hadfield, and Percy Longmuir.

THE series of nickel manganese carbon iron alloys, A–K, whose properties have formed the subject of investigation of this research, has been prepared in the following manner :—

The base of the material used was Swedish charcoal iron of special purity. This was melted along with the necessary ingredients, nickel and Swedish white iron. By these means approximately uniform percentages of carbon and manganese were obtained, the nickel varying from nil to 20 per cent. as aimed at. The series may be taken as showing satisfactory products, as the carbon percentages were on the whole uniform. They vary from 0·40 to 0·52, 0·45 being the figure aimed at. The nickel percentages showed very little loss. The manganese percentages show a variation from 0·79 to 1·03. This element is notoriously difficult to obtain constant in any series of alloys. The exact loss on melting is shown in the table given below.

Hecla Works Mark. 1	N. P. L. No. 2	Nickel Alloy. 3	Percentages. Nickel. 4	Percentages. Carbon 5	Percentages. Manganese. 6	Percentage Loss of Manganese in melting 7
1798 A/4	39	A	Nil	0 47	0 95	24
„ B/3	40	B	1 20	0 48	0 79	29
„ C/4	41	C	2·15	0 44	0 83	34
„ D/2	42	D	4 25	0 40	0 82	40
„ I	43	E	4 95	0 42	1 03	31
„ J	44	F	6·42	0 52	0 92	36
„ E	45	G	7 95	0 43	0 79	42
„ F/3	46	H	12 22	0 41	0 85	45
„ G/4	47	J	15 98	0 45	0 83	46
„ H/3	48	K	19 91	0 41	0 96	[illegible]

TABLE SHOWING COMPOSITION OF ALLOYS.

The present report embodies an exhaustive examination of the mechanical properties of a series of nickel steels containing an average of 0·45 per cent. carbon and 0·88 per cent. manganese.

That certain of the nickel steels are of high value is a fact well known to all engineers. Generally the presence of nickel in, say, a structural steel is regarded as tending to raise the elastic limit and ultimate stress without seriously impairing the ductility. As types of commercial steels the following table gives information :—

No	Analyses Ni	Analyses C.	Analyses Mn	Analyses S.	Yield Point.	Maximum Stress.	Elongation.
					Tons per sq. in.	Tons per sq. in.	Per cent on 2 ins
46	2·950	0·320	0·712	0·052	21 7	39·3	34 0
47	3 010	0 280	0·516	0 123	21 9	39·2	32·5
48	4 175	0·310	0 625	0 112	33·7	50·4	21·5

No. 46 Annealed at 600° C (1,112° F.) to 650° C (1,202° F.)
No 47 Sheffield steel, probably annealed
No 48 German steel oil tempered as supplied

Reference should be made to a manganese-iron-nickel alloy previously described by one of the writers. The high tensile strength and low ductility of alloy J (15·98 per cent Ni) has been previously noted. A similar brittle product, but of much lower tensile strength, is obtained from iron alloyed with manganese to the extent of about 7 per cent.

A most singular feature, discovered by one of the authors, lies in the fact that the simultaneous presence of manganese and nickel in the foregoing amounts confers extremely high ductility, and the results of the following table are of much interest.

No. Alloy	Contents Ni per cent	Contents C per cent	Contents Mn per cent	Yield Point	Maximum Stress	Elongation on 1 75 in	Reduction of Area
				Tons per sq in	Tons per sq. in.	per cent	per cent
A	—	[illegible]	[illegible]	[illegible]	[illegible]	15 42	16 [illegible]
B	[illegible]	[illegible]	[illegible]	[illegible] 07	[illegible]	11 28	14 88
C	[illegible]	0·47	[illegible]	25 79	42 81	17·70	23·51
D	[illegible]	[illegible]	[illegible]	28 11	[illegible]	15 10	17 94
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14 28	24 43
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6 20	8·42
G	[illegible]	[illegible]	[illegible]	41 47	[illegible]	4 50	5 68
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	71 15	6 20	6 88
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	76 55	4·00	4·21
[illegible]	[illegible]	[illegible]	[illegible]	17 94	29 69	14·30	19·03

TABLE SHOWING EFFECT OF PRESENCE OF NICKEL AND MANGANESE IN GIVING HIGH DUCTILITY.

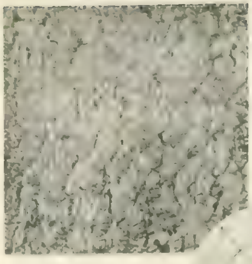


Fig. 39. 150 dia.

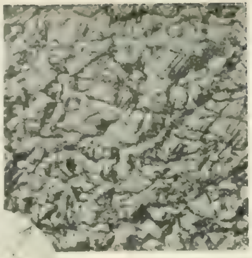


Fig. 40. 150 dia.

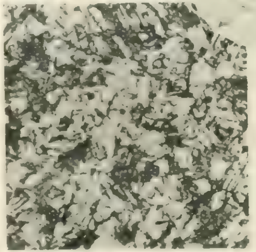


Fig. 41. 150 dia.

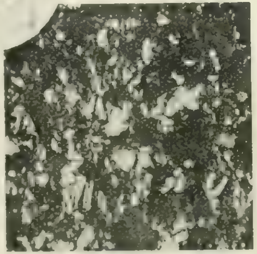


Fig. 42. 150 dia.

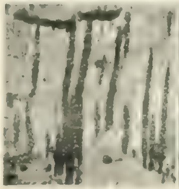


Fig. 43.

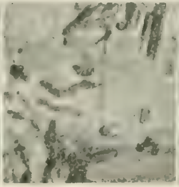


Fig. 44.

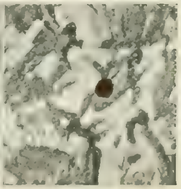


Fig. 45.

Typical structures of above sections × 600 dia.

ALLOY K. ALLOYS RESEARCH. INFLUENCE OF TORSION ON STRUCTURE.

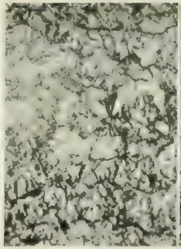


Fig. 46. 150 dia.
Tension side.

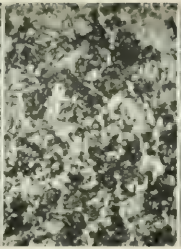


Fig. 47. 150 dia.
Centre.

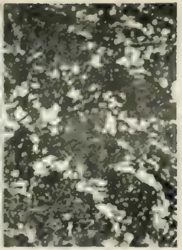


Fig. 48. 150 dia.
Compression side.

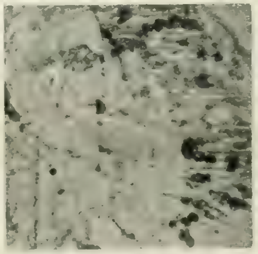


Fig. 49. 1,000 dia.

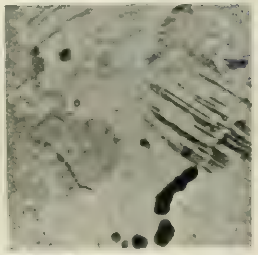


Fig. 50. 1,000 dia.

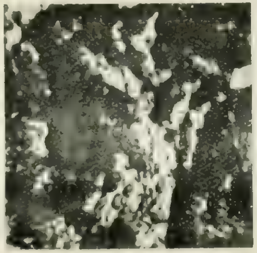


Fig. 51.

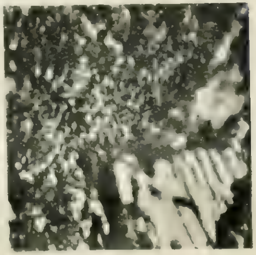


Fig. 52.

ALLOY K. ALLOYS RESEARCH. INFLUENCE OF BENDING ON STRUCTURE.

These results indicate some of the possibilities of manganese-nickel-iron alloys, an ultimate stress of 50 tons and an elongation of 75 per cent. forming a distinct record.

The series of alloys investigated in the research about to be described are practically alloys of iron, carbon, nickel and manganese, the latter element being, however, comparatively low and varying within only small limits throughout the series. The results are therefore not comparable with foregoing researches; still some fairly exceptional properties are recorded in one instance, as reference to the various tests of K will show.

MECHANICAL PROPERTIES.

The tests outlined in the Annual Report of the National Physical Laboratory for 1903 were selected with a view to determine a wide range of properties. Owing to the many test pieces required to cover this range, duplicate determinations could not be made in the majority of cases. But although individual tests were not repeated the concordant results obtained from different methods of testing enhance the value of any one result. For instance, if the results obtained from bending, tensile, torsion, and elasticity tests are compared, coincident properties will be noted. This agreement carries a far higher value when obtained by four different methods of testing, and is certainly more convincing than quadruple tests by one method.

In order to obtain strictly comparative conditions all the tests have been conducted on "material" that has been heated to 800 deg. C.

GENERAL SUMMARY OF THE MECHANICAL TESTS.

The results of the mechanical tests may be summarised. Dealing with this series of tests of the different mechanical properties they all give the same kind of result. With the introduction and increase of nickel content up to [illegible] per cent. the change in the properties is gradual, the material when under elastic stress yields more [illegible] stress; at the same time after the apparent [illegible] point is passed the maximum stress increases. Whilst the change of properties is gradual there is in nearly every case a more or less pronounced kink in the curves between 0 and 4 per cent. nickel. At some point between the percentages of 4·75 and [illegible] nickel there is a very sudden change in nearly all the properties evidenced by a rapid increase of [illegible] which reaches the highest value at [illegible] per cent. nickel, a fall of ductility and an [illegible] as shown by the bending, tension, [illegible] tests. Thus as far as industrial [illegible] concerned, a danger limit [illegible] 4½ per cent., when carbon and manganese are present to the extent of 0·44 per cent. and 0·88 per cent. respectively.

After this sudden break in the curve the various properties alter more slowly again until a percentage somewhere in the neighbourhood of 16 is reached, so that the brittle zone extends from about 5 to 16 per cent. From this point on, the change is more rapid and in the reverse direction to the original rapid change.

Manganese-Nickel-Iron Alloy.

Mark	Analysis.			Treatment.	Yield Point.	Maximum Stress	Elongation on [illegible] ins	Reduction of Area
	Ni	C	Mn					
	Per cent	Per cent	Per cent.		Tons per sq in	Tons per sq in.	Per cent	Per cent
[illegible] D	[illegible]4·55	0·6[illegible]	5·[illegible]	Bar as rolled	27	54	4[illegible]	38
	..	..	..	Unannealed, not toughened	—	56	68	41
	..	..	..	Quenched in water from 1,100° C. (2,012° F.)	18	59	75	47
3417 F				As forged	27	56	on 8 ins per cent 32	42
3418 F	..	..	..	Quenched in water from 1,100° C. (2,012° F.)	20	52	57	52

TABLE SHOWING RESULTS OF TESTS.

The nickel-iron alloys show a sharp decrease in [illegible] at 4·5 per cent. nickel, a slight improvement [illegible] at [illegible] per cent. whilst from 15·48 per cent. to [illegible] per cent. the product is distinctly brittle. At a content of 24·51 per cent. nickel an increase in ductility is shown which is rendered more [illegible] at [illegible] per cent. The alloys included [illegible] are broadly comparable with the authors' [illegible] in that they contain similar contents [illegible] produced under similar conditions. [illegible] the two series show that the [illegible] carbon when present to the extent of [illegible] per cent. [illegible] lower the beginning of the brittle [illegible] between [illegible] per cent. and 4·05 per cent. [illegible] only is the beginning lowered by the [illegible] but also the end of the brittle [illegible] the various tests of K. Ductility [illegible] content of nickel, when [illegible] carbon.

[illegible] researches of M. Guillet's have [illegible] in the [illegible] per cent. carbon series [illegible] in the vicinity of 7 per cent. The [illegible] per cent. carbon series con[illegible] the lowest ductility over a [illegible] nickel. Further Guillet's

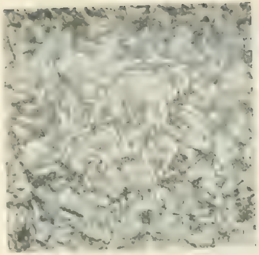


Fig. 62. Typical 150 dia.

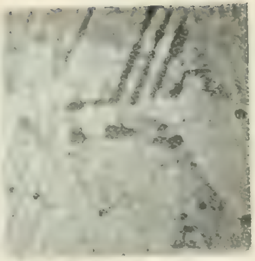


Fig. 63. 1,000 dia.

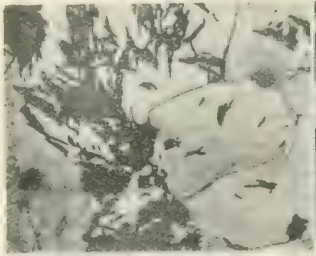


Fig. 64. Typical. 150 dia.

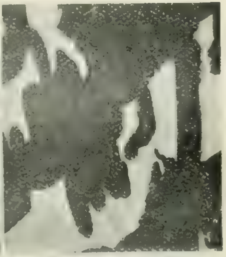


Fig. 65. 1,000 dia.

Alloy K. Influence of tension on cast structure.

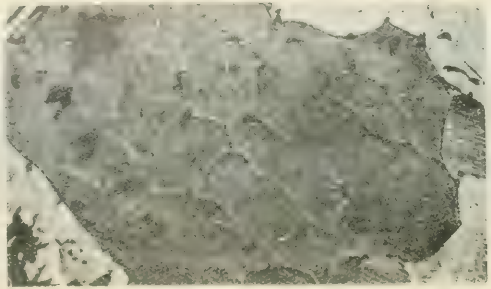


Fig. 66. Typical.

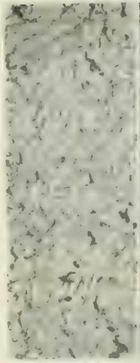


Fig. 67. Bending Typical.

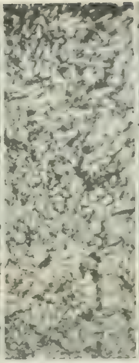


Fig. 68. Tensile Typical.

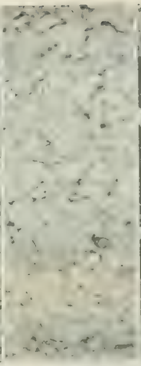


Fig. 69. Torsion Edge.

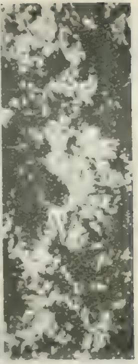


Fig. 70. Torsion Centre

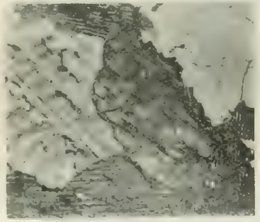


Fig. 28. 75 dia.
Taken with red screen.

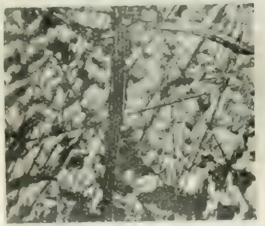


Fig. 29. 75 dia.
Rubbed with 0000 emery.

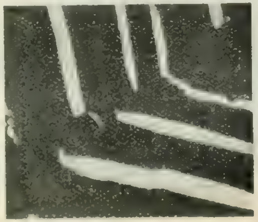


Fig. 30. 1,000 dia.
Black deposit not removed

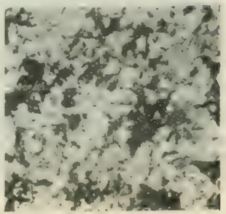


Fig. 59. Trans. at centre.
150 dia.

ALLOYS RESEARCH.

brittle zone, 0·82 per cent. carbon series extends [illegible] to 15 per cent. nickel; the 5 per cent. steel gave an elongation of 10 per cent., whilst the 20 per cent. nickel steel gives an elongation of only [illegible] per cent. K, [illegible] per cent. carbon and [illegible] nickel, gave an elongation of 55 per cent.

PHYSICAL AND CHEMICAL TESTS.

Except the corrosion tests, which are not very sensitive, the sharp change in properties at some point between 4·25 and 4·75 per cent. nickel was well brought out, especially by the resistivity and dilatation tests.

The concluding sections of the research dealing with the critical ranges and structures of the alloys shows how intimately the properties of the various members are associated with definite positions of the critical ranges and with definite types of structure.

Up to 4½ per cent. nickel the positions of the critical ranges on cooling and the types of structure are similar to those of iron carbon steels cooled normally.

From 5 to somewhere between 12 and 16 per cent. nickel the critical ranges on cooling are both lower and very much wider, and the structures are similar to those of quenched iron carbon steels (more or less markedly martensitic).

Between 16 and 20 per cent. nickel a range is entered in which the critical change that takes place on cooling appears to be due to nickel, and the structure is polyhedral. The alloy is non-magnetic at the ordinary temperature.

THE METALLOGRAPHY OF NICKEL STEELS.

The scheme of work has included the microscopic examination of:—

A the cast alloys, cooled from [illegible] deg. C. ([illegible] deg. F.)

B the forged alloys.

C the forged alloys cooled from 800 deg. C. (1,472 deg. F.)

D the cast alloys cooled to −100 deg. C. (−148 deg. F.)

E the structure of K upon which mechanical work of various kinds has been done.

F subsequent heat treatment of K.

Preliminary investigations of the structures of the alloys which had been subjected to the various mechanical tests showed that alloy K is better fitted for complete study than any other members of the series. It has a characteristic homogeneous structure in the untreated state. It consists of large polyhedra, which even after prolonged etching appear white (when the black film left by the reagent has been rubbed off). Mechanical work of several kinds examined by the authors, which stresses it beyond the elastic limit, causes an entirely new type of structure to appear, the [illegible] taking various shapes, but always etching dark. In other words, what may be termed the simplex structure in the unstressed state becomes a duplex structure in the plastic state. Further, magnetism appears with the duplex structure. This well-marked structural change lends itself well to photo-micrographic reproduction.

TENSILE TEST—FORGED BAR.

A [illegible] section as near the fracture as possible [illegible]. This test may be expected to influence the structure equally, the distortion being the same on all parts of a section cut at right angles to the direction of the stress. Examination showed this to be the case, the distortion, as evidenced by the appearance of the black areas, was fairly uniform in all parts of the section. The high power photo-micrographs show that the black bars are grouped in triangles [illegible] as well as quite irregularly.

A section cut from the cast tensile piece, which has a much lower ultimate strength than the forged material and was not so long under stress in the plastic state, shows that although the distribution of the white and black areas was fairly uniform over the surface, yet the two types occur in very much larger patches [illegible]. A field is shown in which a large white polyhedron occurs with only tiny splashes of black structure except for one black patch of [illegible] size (fig. [illegible]).

COMPRESSION TEST FORGED BAR.

[illegible] of the cylinder (barrel-shaped) was filed and polished. Etching developed a series of concentric rings. Although the marks left by the [illegible] tool were quite obliterated in polishing, the etching [illegible] developed these rings. Accordingly [illegible] was ground down ¼ in., polished, etched, and the structure examined. All traces of rings were [illegible] from the edge to a distance of about [illegible] in. [illegible] the structure was unaltered. But there the [illegible] patches appear and increase to a [illegible] at the centre (fig. [illegible]). A longitudinal section cut through the centre of the cylinder showed the same characteristics. The structural changes produced by compression stress increase to a [illegible] at the centre.

TORSION TEST FORGED BAR TRANSVERSE SECTION CUT NEAR THE FRACTURE.

[illegible] of the section where the torsional [illegible] the least strain, shows practically [illegible] structure. A few tiny black [illegible] made out (fig. 59).

These patches gradually increase from the centre to the edge, where they constitute almost the whole of the structure (figs. 40, 41, and 42).

The relative positions of these photo-micrographs are as shown on page 1144.

In positions figs. 40 and 41, several prong-like black lines will be noted. A high-power photo-micrograph of some of these is seen in fig. 43. Other features are typified in figs. 44 and 45.

BENDING TEST FORGED BAR.

A transverse section cut from the place where the bar had undergone on one side the greatest tension, on the other the greatset compression was examined. (The bar had been bent round 180 deg. and was squeezed together in a vice.) Travelling from the tension side of the section, where the black patches are by no means numerous (fig. 46), the latter increase continuously until on the compression side they constitute the larger part of the structure (fig. [illegible]). There is no neutral axis of the bar where no change has occurred.

Under the high power objective, white, yellow, and black tinted patches were found. The yellow patches do not show under low magnification. They probably appear grey under a low power objective. Fig. [illegible] shows the three differently coloured patches. Figs. 46 to 52 show the structures in various parts at [illegible] diameters.

ALTERNATING STRESS TEST -FORGED BAR.

A transverse section was examined as near the fracture as possible. Typical structures are seen in photo-micrographs (figs. 62 and 63). One low and one high power photo-micrograph are sufficient to characterise the field. The black patches are seen in the form of parallel bands the orientation differing from polyhedron to polyhedron. Under high power magnification twinning is sometimes noticed. No cracks were observed.

FORGING TEST.

That the quickly etching material is neither graphitic nor amorphous carbon was shown by taking turnings near the fracture of the piece broken by tensile stress and dissolving them in nitric acid (specific gravity 1·2). They dissolved without leaving a residue. It seems very probable that the new structural constituent is a hard amorphous substance produced by mechanical work on the soft crystalline material, and that the case is parallel to that of silver investigated by Mr. Beilby. The fact that heat restores the white [illegible] [illegible] from the amorphous is also in [illegible] with Mr. Beilby's results.

RESTORATION OF THE ORIGINAL STRUCTURE BY HEATING THE MECHANICALLY STRESSED BARS TO 800 DEG. C. (1,472 DEG. F.).

This treatment is effective in the case of the forged bar, and it is also completely effective in the case of the bending bar (fig. 67). On examining the "torsion" section it was found that the distribution of the black and white areas was altered the dark patches being at a maximum near the centre (fig. 70), and almost entirely absent at the edge (fig. 69). The forged "tensile" section was almost unaltered (fig. 68).

SUMMARY OF RESULTS.

Summarising the results it is seen that the structures induced by (*a*) forging, (*b*) bending and (*c*) compressing which deformed the bars, however, without fracturing them, can be removed and the original types reverted to by a short heat treatment at 800 deg. to 900 deg. C. (1,472 deg.–1,652 deg. F.); while the structural results produced by stresses which caused fracture are not so easy to remove. However in the case of the forged tensile and torsion sections there was an appreciable reversion in parts towards the original polyhedral structure. It seems probable therefore that a prolonged heat treatment at a temperature of about 900 deg. C. (1,652 deg. F.), would cause a complete restoration in every case.

The authors' results are thus not in agreement with those obtained by M. Guillet, who affirms that "a steel which has once been changed from the polyhedric to the martensitic condition by whatever method cannot be regenerated either by annealing or quenching."

Paper read before Institution of Mechanical Engineers.

Messrs. Osbourne, Graham and Co. launched on Saturday from their yard at Hylton, Sunderland, a steel screw steamer which they have constructed for Messrs. William France, Fenwick and Co., Ltd., of Sunderland and London. She is built on the self-trimming principle, and carries 3,100 tons on a shallow draft, and has been constructed to take [illegible] [illegible] highest class. The winches, steam windlass and [illegible] boiler are being supplied by Messrs. Clarke, Chapman and Co., Ltd., of Gateshead; steering gear by Messrs. Alley and McLellan, Ltd., of Glasgow. After the launch, the vessel was taken to the North-Eastern Marine Engineering Works, Sunderland, to receive her engines, which have cylinders [illegible] [illegible] stroke with two large boilers working at a pressure of [illegible] lb.

TECHNICAL SOCIETY NOTES.

WE reproduce in another portion of this issue an abstract of the important paper read before the Institution of Mechanical Engineers on Friday last, on the subject of Iron-Nickel, Manganese-Carbon Alloys. The practical point about the paper is that so far as industrial alloys of this class are concerned, a danger limit for nickel is set at 4½ per cent., when carbon and manganese are present to the extent stated in the paper. The brittles zone extends to from 4¼ to 16 per cent. of nickel. Mr. Hadfield, one of the authors, does not accept all the theoretical conclusions stated in the paper, and he drew attention to the great increase in tenacity at liquid air temperatures. Sir William White referred to the immense value of the research, but a controversial note was struck by Mr. Harbord, who said that as the same thing could be obtained more cheaply by carbon it seems to him that the alloys were of little use Captain Sankey asked for information as to the uniformity of distribution of the nickel in a large ingot, as if the nickel were irregularly distributed, nickel might be present in some portions of the ingot in a dangerous percentage. The discussion was adjourned.

Before the Institution of Electrical Engineers yesterday Colonel H. C. L. Holden read a paper dealing with the application of electricity in the Royal gun factory, Woolwich Arsenal. The subject matter will be dealt with in the next issue of this journal.

At a recent meeting of the Association of Engineers in Charge, Mr. W. H. Webber, who read a paper on "Coal Gas Manufacture and Plant," boldly entered the arena of controversy, and some of his statements have already provoked the retort courteous and otherwise. Here is what Mr. Webber said about central electric stations. Seeing that not more than 60 per cent. of the asset paid for in a central station electricity supply undertaking ever earned anything and that for only 17 per cent. of the time and capacity possible, it followed that this 17 per cent. of the 60 per cent., which was 10 per cent. (about) of the total investment had to bear the whole capital burden. This was the real reason why central station-made electricity, which cost at the works only 1d. per unit or less, could not be sold to the lighting customer under about 4d. per unit to clear all expenses.

"Bulk generation" said Mr. Webber, of which so much has been heard, would clearly not substantially improve this financial condition; for if the current cost nothing at all, an undertaking so based could only reduce the charge to the consumer by so much—that was to say from 4d. to 3d. per unit. Not in respect to generation, therefore, but in storage, was to be sought the key to economical central station enterprise; and this was a generalisation that embraced waterworks, hydraulic power supply, gasworks, and electricity supply. All these undertakings, with the single exception of the last, had means of storing their product in saleable form, and instantly available. Reservoirs, accumulators, gasholders, belonged to this class, and all alike fulfilled the office of compensating regular production for intermittent demand. In the case of central station electricity undertakings alone, the reserve was practically in the form of idle capital and improvidently used expenditure on revenue account which was dead loss. In gas manufacture, whatever profit was made in the retort house could be banked in the holders and shared out between the companies and the public without loss. It was obvious that these boldly stated views should have provoked hostile comment.

At the last meeting of the Sheffield Society of Engineers and Metallurgists, Professor Ripper delivered a lecture on "Some First Principles of Steam Turbine Design." He remarked that the turbine appears likely to supersede the reciprocating engine for high power units, particularly where there is a good supply of condensing water. For marine work the lower limit is fixed at about 5,000 h.p. [illegible] it is not likely at present that the turbine will be so successful. The cause of the difficulty is [illegible] propeller efficiency. For electrical [illegible] of power is available for the successful use of the turbine. Up to [illegible] h.p. for stationary [illegible] for marine work, the reciprocating [illegible] for economy in steam [illegible]

SHIPBUILDING NOTES.

[illegible] *[illegible]*, which has been built at the Wallsend [illegible] of Messrs. Swan Hunter and Wigham Richardson Ltd., for Sir John Jackson Ltd., underwent [illegible] trip on the [illegible]th inst. She is of the following dimensions:—Length over all 350 ft., beam extreme [illegible] ft. [illegible] in., and depth moulded 30 ft. [illegible] in., and she [illegible] to carry a deadweight cargo of about [illegible] tons on a moderate draught of water. The machinery has been constructed by the Wallsend Slipway and Engineering Co. Ltd., and consists of a set of triple expansion engines having cylinders 25½ in., [illegible] in. and [illegible] in. by 48 in. stroke, steam being supplied by two large single ended boilers working at 180 lb. pressure and fitted with Howden's system of forced draught.

The steel spar decked steamer *[illegible]*, built to the order of Messrs. Joseph Chadwick and Son, Liverpool, was launched recently from the Southwick Yard of Messrs. Robert Thompson and Sons. Her principal dimensions are:—Length overall 350 ft., breadth [illegible] ft. [illegible] in., depth moulded 27 ft. 8 in. She is designed to carry a large cargo on a light draught of water, and is constructed with extra strengthening to obtain Lloyd's minimum freeboard for three-decked vessels. There are five large hatchways with eight powerful steam winches, a large multitubular donkey boiler, and double derricks for the rapid loading and discharging of cargo, the masts being fitted up with [illegible] and derrick tables. The engines are being supplied by The North Eastern Marine Engineering Company, Ltd., of Sunderland, having cylinders [illegible] in., [illegible] in. and [illegible] in. with a stroke of [illegible], [illegible] three large boilers of 180 lb. pressure.

Messrs. Craig Taylor and Co. Ltd. launched on the [illegible] inst. from their Thornaby Shipbuilding Yard, Stockton-on-Tees, a spar deck screw steamer of the following dimensions: 337 ft. by 41 ft. 9 in. by 27 ft. [illegible] in. depth moulded. She is built of steel to the highest class in Lloyd's and Austrian Veritas under [illegible] survey, with long poop, bridge, and topgallant forecastle, [illegible] decks sheathed. She is equipped with [illegible] winches of special type, steam steering gear [illegible] with quick warping ends and [illegible]. Her engines have been constructed by the North Eastern Marine Engineering Company, Ltd., Sunderland, the cylinders being [illegible] in., [illegible] in., and 65 in. by 45 in., with two large steel boilers to work at 180 lb. pressure, with Howden's forced draught, bronze propeller, etc.

The number of vessels of all kinds launched on the Tyne during the month of the past October was eleven, of an estimated register tonnage of [illegible] tons, the total from January [illegible] to October [illegible], 1905, being [illegible] vessels of an estimated register tonnage of [illegible] 457 tons.

On Saturday the new steamer [illegible], built by Messrs. Ropner and Son, Stockton-on-Tees, to the order of Messrs. R. Chapman and Son, of Newcastle-on-Tyne, made her official trial trip in Tees Bay, when she attained an average speed of [illegible] knots per hour. The vessel is 414 ft. in length and has a deadweight carrying capacity of about [illegible] tons. The machinery is by Messrs. Blair and Co. Ltd.

Messrs. S. P. Austin and Son Ltd. recently launched the steel screw steamer *[illegible]*, of 1,700 tons deadweight capacity, which has been built to the order of Messrs. Wm. Cory and Son Ltd., of London. She is designed for the coal trade and suitable for shallow harbour work. Machinery will be supplied by Messrs. George Clark Ltd., of ample power to enable her to make fast passages.

On Saturday, the 11th inst., Messrs. Harland and Wolff, Belfast, launched the large [illegible] screw steamer *Malakand*, the second of the [illegible] steamers of similar dimensions, which they are building to the order of Messrs. T. and J. Brocklebank Ltd., for their Liverpool and Calcutta service. The new vessel is [illegible] ft. long by 58 ft. beam, and about [illegible] tons gross. She will have a deadweight carrying capacity of over [illegible] tons. The holds, five in number, are of ample capacity, the hatches being of such a size as to accommodate locomotives, boilers, machinery, etc., of the largest dimensions. The engines and boilers for the vessel are also being constructed by Messrs. Harland and Wolff, the engines being of the [illegible] expansion type.

THE USES OF HIGH-SPEED STEEL.*

By J. M. Gledhill.

Most businesses have their proportion of enthusiasts and pessimists, and the business of engineering and steel making forms no exception to the general rule. It is sometimes asserted that high-speed steel is of comparatively small importance, and that on the whole not much advantage or economy results from using it. It is not difficult to prove greatly to the contrary, and it is the writer's intention to now present such figures and examples as will show most clearly that great economies can and are being continuously effected by its use, when due attention is bestowed in dealing with it.

It has been proved that the use of high-speed steel, cutting at high speeds, is economical in mechanical efficiency, and that a given horse-power will remove a greater quantity of metal at a high than at a low speed, and that the horse-power absorbed for each pound of metal cut will be less when cut at a high speed than when cut at a low speed.

INCREASED PRODUCTION FROM OLD MACHINES.

Other conditions being equal a greater power is naturally required to remove metal at a high than at a low speed (by reason of the increased quantity of work done), but the increase of that power is by no means in proportion either to the extra amount of work obtained, or the reduced cost of producing the article required, for the reasons that the frictional and other losses do not increase in anything like the same ratio as the increase of cutting speed. Again, it has also been shown that the load or pressure on the tool whilst cutting is not increased by reason of cutting at higher speeds, so that for the same area of cut the stresses due to cutting are not more than when operating at lower speeds, thus enabling increased production to be obtained from old machines by merely speeding up by replacement with larger pulleys, etc.

Such alterations in old machines can, of course, only be pursued within certain limits of working stresses in the gearing, for whilst the statical stresses on the machine frame are not greatly increased the kinetic stresses are, which, together with increased vibration, render the employment of machines, specially designed to meet those conditions imperative and highly desirable to work high-speed steel to its full capacity.

The use of high-speed steel also makes it possible to reduce shop charges in production, by reason either of the increased output from the same installation, or a reduction in labour and machines for an equal output. In laying down new works and plant, the adoption of high-speed steel has now considerable influence in reducing expenditure on capital account, fewer machines being required and less ground area, etc.

COMPARATIVE EXPERIMENTS.

It will be interesting to refer to some comparative experiments with a view of ascertaining the saving in power absorbed with high-speed cutting.

Cutting on hard steel, with $\frac{3}{16}$in. depth of cut $\frac{1}{16}$in. feed, and speed 17 ft. per minute, a power of 5·10 h.p. was absorbed, and increasing the cutting speed to 42 ft. per minute, the depth of cut and feed being the same, there was a saving in power of 10 per cent. for the work being done.

---

* For "Facts about High-Speed Tool Steel," by the same author, see Page's Magazine, May, 1904, and "The Heat Treatment of High-Speed Tool Steel," Page's Weekly, January 20th, 1905.

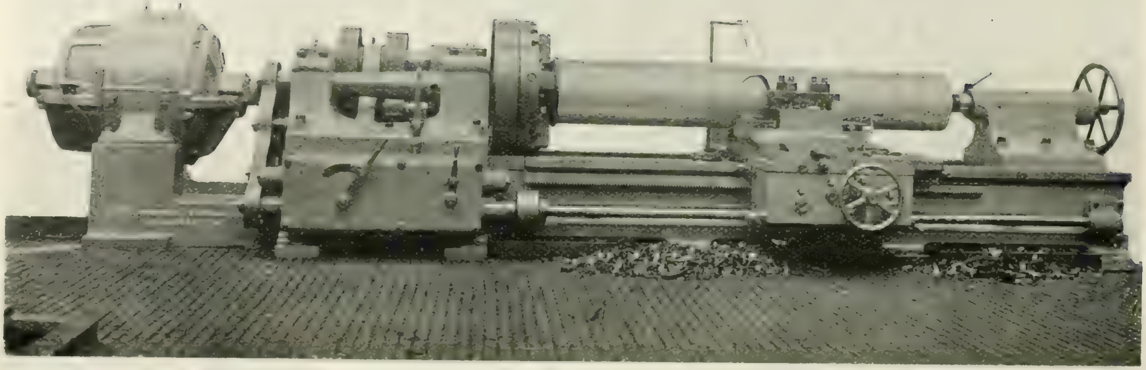


FIG. 1. 18 IN. HIGH-SPEED LATHE BY SIR W. G. ARMSTRONG, WHITWORTH AND CO., LTD.

Cutting steel at 100 ft. per minute; 1 in. depth of cut; $\frac{1}{8}$ in. feed. Removing 2,545 lbs. per hour with "A.W." steel. The lathe is driven by a 60-h.p. motor.

Another experiment with depth of cut $\frac{3}{4}$ in., and traverse $\frac{1}{8}$ in., compared with $\frac{1}{16}$ in. traverse and $\frac{3}{16}$ in. depth of cut showed a saving in power of as much as 28 per cent. and still proceeding, with a view of increasing the weight of metal removed in a given time, the feed was doubled (other conditions being the same) and a still further saving of power resulted. In a word, as in the majority of things, so it is with rapid cutting: the more quickly work can be produced the cheaper the cost of production will be.

Regarding the question of economy there is not only a saving effected on the actual machine work, but the upkeep of these cutting tools is also considerably reduced, owing to the great endurance of high-speed steel, so that the former expensive costs entailed by frequent forging and grinding when using the old steels are greatly reduced.

EFFECT ON WORKSHOP PRACTICE.

The advent of high-speed steel has now also changed many old workshop practices and operations. At the writer's works wherever possible, all articles such as bolts, set screws, small shafts, nuts, pins, etc., are no longer made as forgings—all smith work is absolutely dispensed with—and such articles are made from plain rolled bars machined rapidly to

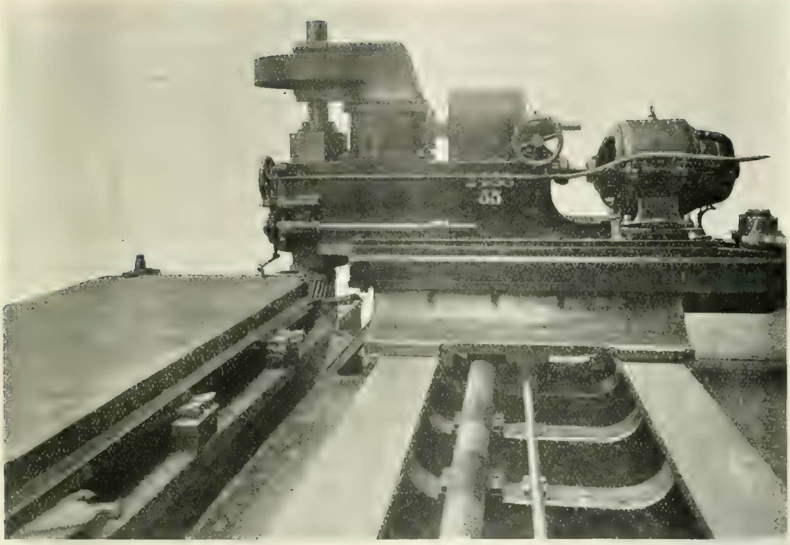


FIG. 2. VERTICAL MILLING MACHINE WITH HIGH-SPEED MILLING CUTTER WITH INSERTED TEETH.

Milling hard chrome steel armour plate. Cutting speed, 75 ft. per minute. Depth of cut, 2⅝ in.; width, 3¼ in. Feed per hour, 16 in.

shape with high-speed steel. Many examples of this system of manufacture are available.

ARMOUR PLATE BOLTS, AND SLEEVES.

Formerly in the manufacture of armour-plate bolts and sleeves, when forgings were first made and afterwards machined with ordinary steel, eight bolts were produced daily as against forty now with the use of high-speed steel operating on plain rolled bars. The cost of forging to shape only of one of these bolts was formerly as great as the cost now is for producing twelve bolts from the rolled bar. The cutting speed at which these bolts were turned was 160 ft. per minute, ¾ in. depth of cut and $\frac{1}{32}$ in. feed, 2,480 lb. of metal being removed per day, and the tool requiring to be ground only once in seven hours.

DYNAMO SHAFTS, ETC.

Similar practice may be adopted in the production of dynamo and motor shafts, piston rods, bolts, screws, pins, etc., from steel of suitable composition and strength for the purpose for which the articles are to be used. Equally satisfactory results may be obtained when operating on cast-iron. Some trials were recently made in New York with "A.W." steel turning cast-iron piston-blocks of 20 in. diameter by 5 in. wide for air compressors. With a cutting speed of 150 ft. per minute, $\frac{3}{16}$ in. depth of cut, $\frac{1}{32}$ in. feed, five such castings were turned with a high-speed tool, ¾ in. by 1¼ in. section, the tool suffering no injury whatever. Again, machining a winding drum for elevator, 30 in. diameter, and 24 in. long, the whole length was cut at a speed of 102 ft. per minute, ⅛ in. to ¼ in. cut, and $\frac{1}{32}$ in. feed.

HEAVY CUTTING.

Some doubt has been expressed as to high-speed steel being somewhat unsatisfactory in cases where heavy cutting is desired, and where the tool is subject to shocks, objections being raised on account of its alleged brittleness. This is not the case if the steel has been properly annealed, the hardening confined to the cutting area, and proper support given to the tools when fixed in the machine. When taking heavy cuts it should be remembered that where the tools are quite flat on the bottom side and well supported, the pressures tending to break them are largely reduced.

In connection with heavy cutting, it will be interesting to refer to the powerful lathe constructed by the writer's company for the purpose of demonstrating the powers of their high-speed steel at the Liége Exhibition. The massive proportions of the lathe, which is of 18 in. centres and driven with a 60 h.p. motor, will be gathered from fig. 1, while the following table will convey some idea of the possibilities of the cutting powers of the steel in this modern machine tool.

Brand of Steel used	Material Cut	Cutting Speed feet per minute	Reduction in diameter	Feed per Revolution.	Weight of Metal removed per hour
				Ins.	Lbs.
"A W"	Forged Steel	160	$\frac{5}{8}$	$\frac{1}{16}$	611
"	..	100	2	$\frac{1}{8}$	2,545
"	..	42	2	$\frac{1}{4}$	2,140
"	..	38	1	$\frac{1}{2}$	1,935
"	..	32	$2\frac{1}{2}$	$\frac{1}{4}$	2,039

In the early stages of the development of high-speed steel, it was frequently found that but moderately successful results were obtained when cutting hard varieties of steel and cast-iron. Greater experience in its use and manufacture has now enabled these early difficulties to be overcome.

PLANERS.

Coincidently with the increase of rotary cutting speeds, have been those of reciprocating machines, notably in planing machines, and

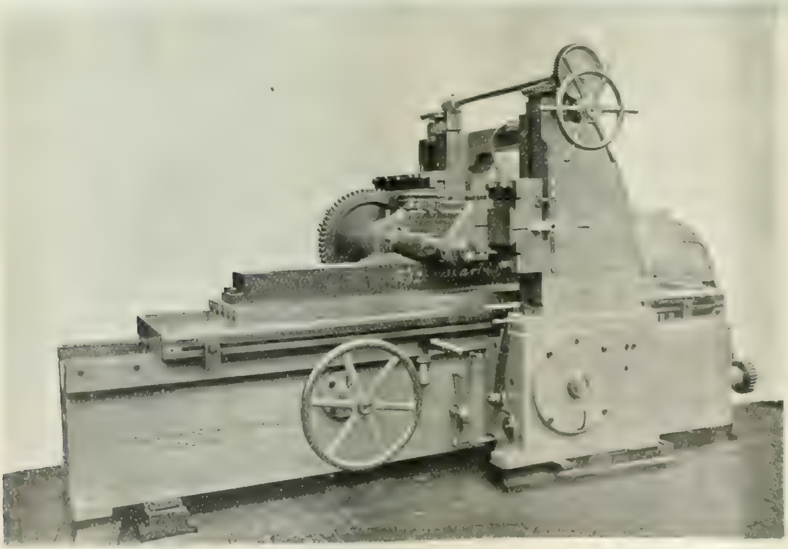


FIG. 3. HIGH-SPEED SLAB MILLING MACHINE, WITH [illegible] H.P. MOTOR.

Using "A.W." cutters, and cutting steel at 180 feet per minute, [illegible] in. depth of cut, [illegible] and feeding 6-in. per minute.

it is indeed astonishing to observe the advances that have been made in this direction. Whereas formerly cutting speeds of 15 to 25 ft. per minute were thought good enough, now speeds of 50 to 60 ft. per minute are by no means uncommon, and in some cases much higher; even up to 80 ft. or more. Of course high-speed cutting steel is equally adaptable to planing, slotting, milling, and drilling machinery.

MILLING AND GEAR CUTTERS.

Steel for use in milling and gear cutters should be reasonably tough, with a capacity for retaining a sharp cutting edge, and combined with great powers of endurance, for if the edges become quickly dulled greater power will be required, while the resulting finish of the work will not be of a satisfactory character, and since the grinding and setting up of a milling cutter is comparatively a more or less costly operation, only steel possessing qualities as enumerated above should be used if good results and economies are to be effected.

In the milling machine illustrated in fig. 2, hard chrome steel armour-plate is being milled at 75 ft. per minute, the depth of cut being 2⅝ in., and the width 3¼ in., at a travel of 16 in. per hour. The body of the cutter is made of mild steel and fitted with blades of "A.W." steel.

Attention may be drawn to the machine illustrated in fig. 3, this machine having been specially designed and constructed for the purpose of demonstrating the milling powers of the high-speed steel cutters at Liége. This machine is driven by a 40 h.p. motor, and the following table will convey some idea of what we may expect being able to regard as good practice in the near future.

Brand of Steel and Size of cutter used.	Material cut.	Cutting Speed feet per min	Metal under cut.		Travel per min.	Weight of Metal removed per hour
			Depth	Width.		
"A.W." 6in. dia. × 12in. long	Forged Steel	192	⅛in.	7½in.	8in.	127
"A.W." do.	Do.	180	½in.	7½in.	6in.	382
" do	Do.	75	1¾in.	7½in.	1·2in	191
" 5in dia.	Cast Iron.	107	¾in.	6in.	4in.	305

MILLING WITH HIGH-SPEED CUTTERS.

TWIST DRILLS.

Perhaps one of the most useful of all the applications following the development of high-speed steel has been the manufacture of twist drills from it. In former days many attempts were made to produce twist drills from the ordinary self-hardening steel with usually but indifferent success. Now, however, drills of high speed steel are to be found in most shops, and it is certainly to the credit of British engineers that they have responded so energetically to the demand for them, with the result that they are now sending twist drills of high-speed steel to all parts of the world.

Some trials were made by the writer's firm

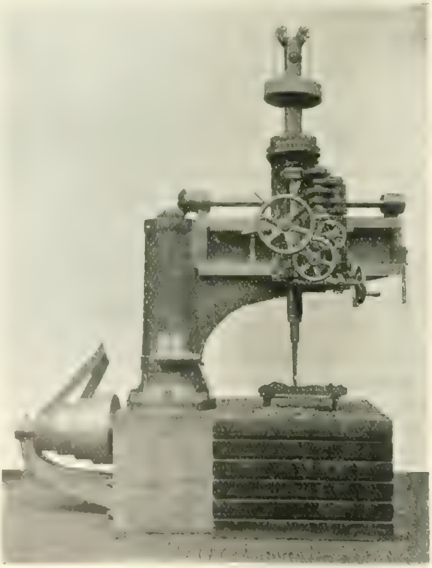


FIG. 4. HIGH-SPEED RADIAL DRILLING MACHINE, WITH POSITIVE FEEDS.

Drilling [illegible]-in. diam. holes through steel plates at 10-in. feed per [illegible] high-speed steel drills, by Sir W. G. Armstrong, Whitworth and Co., Ltd.

in a new radial arm machine of their own manufacture designed for using high-speed drills and fitted with positive geared feeds, the width of the driving belt being 5 in., and giving ample power. For the purposes of the trials a number of drills were taken from stock, so that the results would be representative of the capacity of drills usually manufactured. The results show beyond any possible doubt that under ordinary conditions and in suitably designed machines it is practically impossible to break these drills. Samples of drilling work are here appended. The machine referred to is illustrated in fig. 4.

Diameter and Brand of Drill used.	Material Drilled	SPEED		FEED.		No. of Holes Drilled	Condition of Drill.
		Revs of Drill per Minute	Cutting Speed feet per Minute	Cuts per inch of Traverse.	Feed inches per Minute.		
1 A W High Speed	Two ¾in. Steel Plates secured together.	497	130·1	46	10·8	50	Good
¾ ..	..	497	97·6	46	10·8	50	Good
⅝ ..	..	497	81·3	46	10·8	50	Good
½ ..	..	497	65	46	10·8	50	Good
⅜ ..	..	497	48·8	46	10·8	50	Good
¼ ..	..	497	32·5	46	10·8	28	End of drill broken
[illegible]	2in. Cast Iron Plate	630	129·0	35	18	400	Good

Note.—497 revolutions represent the maximum speed of machine.

These results, it will be seen, show the high-speed drills to possess great torsional strength, for, with a feed of 46 cuts per inch (0·21 in. per revolution) when drilling steel of the strength and depth stated, and with the size of drills used, the test in this respect is indeed a severe one. Of course, it should not be inferred from these results that it is advisable to always work drills at such speeds and feeds, for the latter especially is dependent to a very great extent upon the character of the work being drilled, and also the rigidity and excellence of the machine used, and it cannot be expected to obtain such results unless the machines are up to the work the steel will do.

Other applications of high-speed steel are of a varied and extensive character, embracing many fields of industry.

From a paper read before the Glasgow and West of Scotland Foremen Engineers' and Draughtsmen's Association.

OPENINGS FOR TRADE IN ARGENTINA.

Consideration is being given by Congress to a project for a large system of irrigation works in the national territories, and some of the up-country provinces. If efficiently carried out, large tracts of land which up to the present have remained barren will, it is stated, be opened up to cultivation and settlement. The estimated cost of the scheme is fifteen million dollars.

The Senate have granted a concession to M. F. Mulhall for the construction and working of a commercial port in the Bay of Saint Blaise.

The Ministry of Public Works have brought before Congress a project for the construction of a port in deep water in the estuary of Bahia Blanca near the military port, at an estimated cost of £2,000,000. The port would be constructed and worked by the Government.

The Chamber of Deputies has authorised the construction by the Executive of the following railways:—1. From Goya (province of Corrientes) to a point between the stations of San Diego and San Roque, on the Argentine North Western Railway. Length, [illegible] kilometres. 2. From Santo Thomé to Posadas (Misiones). Length, 146 kilometres.

Messrs. A. Madero and Co. have been granted a concession for the construction of a railway and a port. The line will start from San Antonio in the Gulf of San Matias, and take a northerly direction for 70 kilometres, and then run parallel with the Rio Negro, crossing it to the west of Choele Choel Island, then northwards through Alvear, Medano Colorado to Mercedes in the Province of San Luis, with a branch from San Antonio to Bahia Blanca. The concession for the port, which is to be constructed at San Antonio, is for 50 years.

The following projects are reported to have met with the approval of Congress:—Construction by the Government of railways from Cerrillos to Rosario de Lerma; Ledesma to Embarcaciones on the Bermejo; Brocho, or Santa Rosa, to Leales and Cejas to Berruyacú. The Entre Rios Railway Company to extend their lines to Buenos Aires, crossing the Parana by means of steam ferries. Messrs. Quesada Hnos. to build an electric line from the Capital to Lujan. In addition, the Buenos Aires and Pacific Railway Company have applied to the Government for authority to construct a new terminus at Retiro with various improvement works in connection therewith.

OUR WEEKLY BIOGRAPHY.

PROFESSOR WILLIAM CAWTHORNE UNWIN, B.Sc., F.R.S., M.Inst.C.E.,

Member of the Council of the Institution of Civil Engineers.

PROFESSOR W. C. UNWIN, who recently retired from the professorship of civil and mechanical engineering at the Central Technical College, was born at Coggeshall, Essex, in 1838, he being the son of the late William Jordan Unwin, LL.D., principal of Homerton College. Educated at the City of London School, he afterwards served his pupilage with Sir William Fairbairn, of Manchester.

From 1861 to 1868 he was engaged in managing engineering works. At the end of this period he entered upon his academic career as an instructor in marine engineering at the Royal School of Naval Architecture, South Kensington. In 1872 he was appointed head of the hydraulic engineering department at the Royal Indian Engineering College, Cooper's Hill. After having occupied this post for about fifteen years, Professor Unwin was elected for the chair of civil and mechanical engineering at the Central Technical College, City and Guilds of London Institute.

PROFESSOR WILLIAM CAWTHORNE UNWIN, B.SC., F.R.S., M.INST.C.E.

Professor Unwin acted in 1890 as secretary of the International Commission on the utilisation of the Niagara; two years later he occupied the presidential chair of Section G of the British Association, and about five years ago he was elected a member of the Senate of the London University. He is well known as a technical writer. His more important works include "Wrought-iron Bridges and Roofs," "Elements of Machine Design," "The Testing of Materials of Construction," and "The Development and Transmission of Power from Central Stations." He has contributed a number of scientific papers to various learned societies, and is the author of the articles in the "Encyclopaedia Britannica" dealing with hydraulics and bridges. He is an honorary member of the Institution of Mechanical Engineers, an honorary member of the American Society of Mechanical Engineers, and an honorary associate of the Royal Institute of British Architects.

NEW MODEL 7-ft. "NILES" UNIVERSAL RADIAL DRILLING MACHINE.

BY THE NILES-BEMENT-POND COMPANY.

THIS machine is the result of the experience of the Niles-Bement-Pond Company's five works in the design and manufacture of radial drills, and is built to use high-speed drills to their fullest capacity. The machine illustrated will drill to the centre of a 14 ft. circle, and has a spindle diameter of 2¾ in., with Morse taper socket No. 5. The arm rotates on the column and the saddle swivels at any angle on the arm, thus making it possible to drill at any desired angle. The drill head saddle fits between as well as outside the arm guides, which completes the double-box section of the arm, and insures great rigidity.

The column saddle is strongly gibbed to flat bearings on the column, and the post about which the column revolves extends to the extreme top of the sleeve. The use of large shafts, steel gears, bronze bushings, and ring oiling bronze bearings for all fast-running shafts makes a strong durable machine, capable of standing the hardest service. All the feeds and speeds are changed by means of levers, care having been taken to arrange the levers and hand-wheels, so that they shall be within easy reach of the operator, thus making the machine extremely convenient and easy of manipulation. The column rests on ball bearings. Friction clutches are used for starting and stopping the machine at high speed, so as to prevent shock and consequent wear.

This machine is furnished with either belt or motor drive, the belt-driven machines having single pulley-drive through speed box. The change from belt-drive to motor-drive is easily accomplished by the simple substitution of two gears for the pulley, the top of the speed box being planed ready to receive the motor. The drill head is furnished with reversing gears for tapping. All speeds and feeds may be changed while the machine is running even at its higher speed. The main dimensions of the machine illustrated are as follows:—

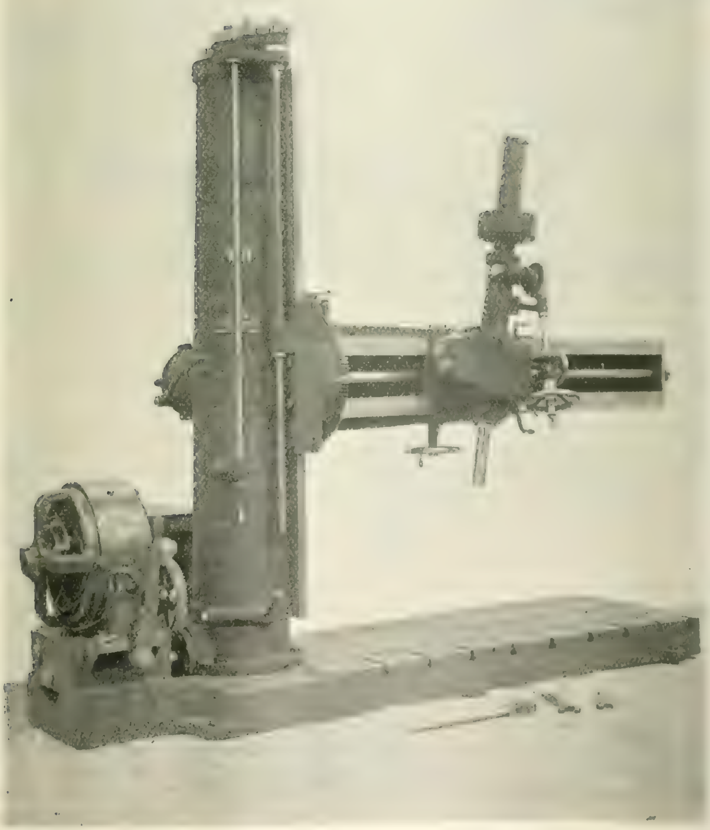
Maximum radius of drill head ..	7 ft.
Maximum distance base plate to spindle	78 in.
Maximum distance face of column to drill centre	86 in.
Minimum distance ditto ditto	22½ in
Number of feeds	8
Number of spindle speeds	16
Diameter of spindle	2¾ in.
Travel of spindle	20 in.

The machine shown is driven by a direct connected 5 h.p. motor, and has two tables for bolting the work down, viz., the main base plate and a box table at right angles thereto.

One of the principal features of this machine is that it is a full universal machine, both the arm and the saddle swivelling and the column describing a full circle.

THE CALENDAR SEASON.

Messrs. W. Summerscales and Sons, Ltd., of Phœnix Foundry, Keighley, remind us that the season of calendar distribution is once more approaching by sending a date reminder designed to be effective for the next two years. It is an eminently serviceable and creditable production, available for either wall or desk use. The white 4 in. square bearing a month's dates in black and red appears in a vermilion circle, 8 in. in diameter with the firm's title and address in cobalt on silver in the margin. Incidentally we are reminded that their chief specialities are modern laundry and cooking apparatus.



NEW 7 FT. MODEL NILES RADIAL DRILL, MOTOR DRIVEN.

BY THE NILES-BEMENT-POND COMPANY.

ELECTRICAL POWER SUPPLY IN MINES.

WITH SPECIAL REFERENCE TO LARGE WINDING PLANTS.

By A. SPIER.

(*Continued from page 1094.*)

SWITCHBOARD CONNECTIONS AT THE GRAND HORNU COAL MINES.

Each of the aluminium conductors is brought to an oil switch and thence to the main bus-bars. The switch-board is so arranged that all parts carrying high-tension current are erected beneath the floor. On the panels are the hand-wheels for operating the main switches, as also the apparatus for paralleling the generators, and the necessary measuring instruments. Arranged on the right-hand side are the continuous current switches and ammeters, etc. On the left-hand side is arranged the gear for the control of the outgoing three-phase leads, with their corresponding ammeters. The operation of the high-tension switches takes place by means of press-contacts, which work continuous-current relays. When the switch is closed, a glow lamp lights up, and is again extinguished as soon as the switch is open. High-tension fuses are dispensed with by constructing the switches as maximum cut-outs so that, in case of excess current they automatically open the circuit. This is effected through the same magnets which are actuated by the press-contacts. In each of the three phases a current transformer is connected up in the secondary circuit of which is arranged the maximum relay. To facilitate the overhauling of switches, etc., when the central station is at work, they can be disconnected from the bus-bars by means of link switches. The cables used for the high-tension current consist of three-core rubber-insulated cables with iron armouring; duplicate cables are taken to the motors driving the ventilators, one of these [illegible] being always as a spare.

WINDING PLANT.

Of the three winding plants the first to be laid down were the two larger ones for shafts 7 and 12, the former of which [illegible] set to work in June, 1904. Both plants are designed to ultimately wind from a depth of 3,280 ft.; the present depth at Shaft 7 is 2,300 ft. and at Shaft 12 [illegible]. The type of winding rope specified was the flat aloe rope which is in general use in Belgium, and [illegible] for the former steam winding plants.

In [illegible] avoid all interruptions of the service, it was [illegible] that the existing steam winding plants would continue to work until the electrical winding plants, erected in line behind them, were ready, so that the only thing necessary to do would be to change over the ropes from one to the other. On account of the great weight of the aloe ropes, they are generally made tapered. For 1,000 metres depth, the ropes were specified as follows :—

Step (Metres)	Width × Thickness m.m.	Weight in kgs.
0–130	320 by 40 (12[illegible] in. by 1[illegible] in.) ..	1,852
130–200	310 by 47	968
200–300	300 by 45	1,250
300–400	280 by 43	1,100
400–500	270 by 41	985
500–600	250 by 38	890
600–700	240 by 36	840
700–800	230 by 34	825
800–950	220 by 33	1,225
950–1,100	215 by 32·8 ([illegible] in. by 1[illegible] in.) ..	1,065
		11,000

Approximately 11 long tons.

The calculation of the winders was based on the following data :—

Depth of shaft	3,280 ft.
Coal raised per hour ..	65 long tons.
Effective load per journey ..	5,700 lb.
Weight of the cage ..	4,400 lb.
Six tubs at	400 lb. each.
Weight of the rope ..	11 long tons.

The diameter of the hub of the winding reels is 4 ft. 7 in.; in order to obtain a good balancing of the weight of the rope the initial over-all winding diameter had to be calculated about 8 ft., 64 coils for a complete journey from [illegible] ft. depth and an end diameter of 24 ft. 10 in. As 65 tons per hour were to be hoisted twenty-five trips in the hour had to be provided for, the duration of each amounting to 144 seconds. In order to avoid [illegible] over five times as is necessary with three-deck [illegible] when wound by reels, hydraulic arrangements were provided, thus allowing to operate independently [illegible] the top and bottom. Under these circumstances [illegible] stops for loading and unloading

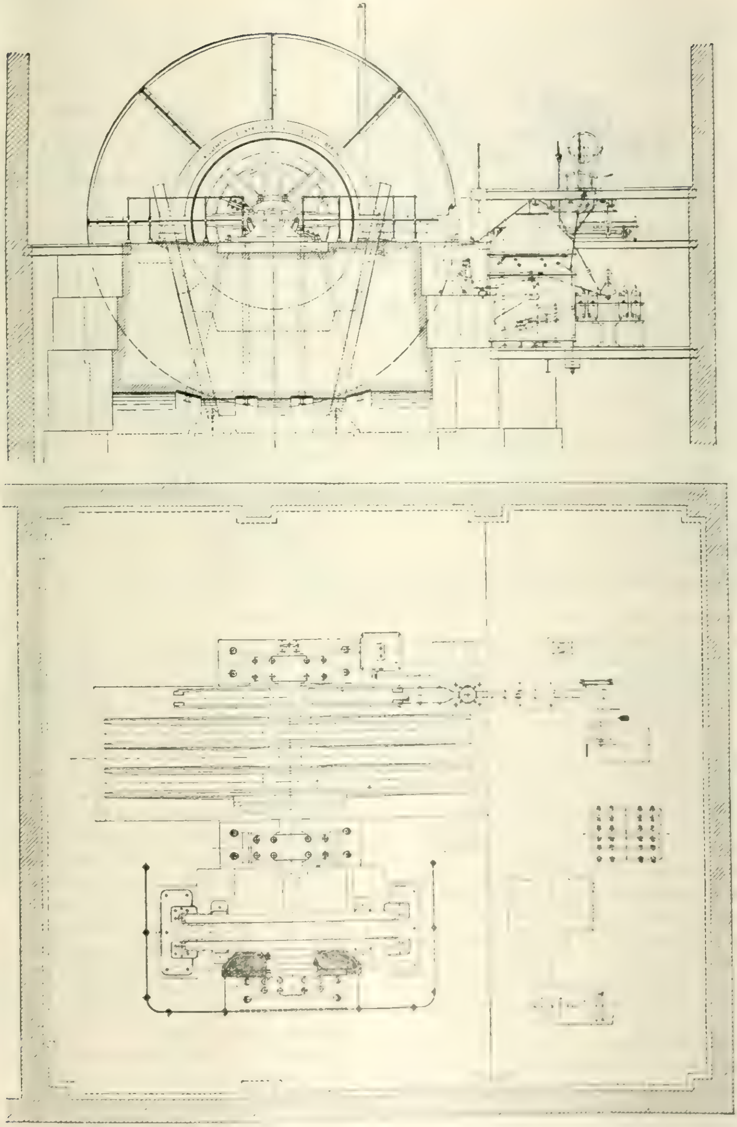


FIG. 4. GENERAL ARRANGEMENT OF WINDING PLANT, GRAND HORNU COAL MINES.

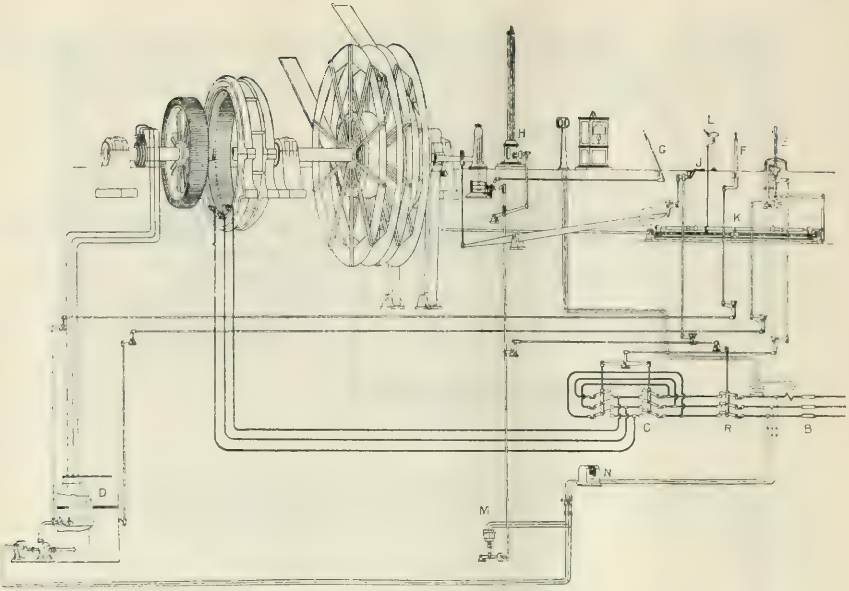


FIG. 5. SYSTEM OF CONTROL.

A. Emergency Switch. B. High Tension Fuses. C. Reversing Switch. D. Liquid Starting Resistance and Regulator. E. Main Controller Lever. F. Auxiliary Lever for Regulation of the Starting Torque. G. Lever for the Steam Brake. H. Depth Indicator. J. Foot Lever actuating the Emergency Switch. K. Slowing Down Gear. L. Lever for alteration of the Speed when Winding Passengers. M. Electro-magnetic Brake. N. Transformer for the Electro-magnetic Brake and Electric Pump for the Starting Resistance.

could be taken at 35 seconds. For the acceleration period 15 seconds were taken. The revolutions per minute of the winder, therefore, becomes 42.

The moment of inertia of the moving masses, including rope and rope-pulleys, totals 186,000 ft. lb.

For the present winding requirements from 2,300 ft. depth, a rope, shortened by a suitable amount at its [illegible] end, is used. With an initial winding diameter of 7 ft. 7 in. there are 52·1 coils per journey, and the end diameter amounts to 20 ft. These figures correspond to the conditions with new ropes, as older ropes stretch a certain amount after being in use for some time.

The general arrangement of the winding plants is represented in the drawing fig. 4. Of the two reels, one is fixed on the shaft, the other can be set round the shaft in order to adjust the wheels relatively to each other as the winding stages are altered. The hubs is of cast iron and the arms are built up of rolled iron, faced with a layer of hard wood for the preservation of the rope. The cast-iron brake disc is arranged directly on the shaft, so that the reels themselves, with the exception of the hubs, can be of comparatively light build. The shaft runs in two massive bearings, and is flanged at one end, where it is coupled up to the motor shaft.

The motor and electrical equipment of the winding plant have been designed on similar lines to those of the first large electrical winder laid down at Preussen II. pit, near Dortmund, and which, after being at work day and night for two years, have demonstrated in every possible detail their thorough reliability and flexibility in meeting all the requirements of control under working conditions.

The three-phase motor, the stator of which is built up between two end blocks, is capable of taking heavy overloads, and can, if necessary, hoist one cage unbalanced. The rotor frame consists of a spider and rim built up as a link work. This design has shown itself to be especially advantageous in facilitating cooling and in reducing the moment of inertia of the rotor to a minimum.

SYSTEM OF CONTROL

The system of control will be understood from the diagram of connections, fig. 5. The current coming from the power-station goes first through an emergency switch to a reversing switch, which permits of running the motor in one direction or the other. This reversing switch is operated from the driver's lever and is worked in exactly the same manner as the lever of a steam hoist. In the mid-position, the current is switched off and the motor is disconnected. By now moving the lever backwards or forwards, the connections are made for the running of the motor in one or other direction. The actual starting of the motor and the speed regulation takes place through the rotor circuit by the use of a water-starting and regulating resistance.

The three phases of the rotor are brought to three groups of plates which are insulated and suspended in a water tank. A constant circulation of a weak soda solution is kept up through this tank and through a reservoir arranged underneath it, and, as soon as the regulating valves at the base of the upper tank are adjusted the liquid begins to rise and forms a passage for the current between the plates, thereby causing the motor to start. The higher the liquid rises the smaller becomes the resistance in the rotor circuit and the motor runs up gradually to its full speed; this latter is finally attained when the liquid has reached the overflow point.

The tank valves are opened and shut from the driver's controller lever, which, as already mentioned serves as the reversing lever for the winding motor. As soon as the lever is actuated by the driver for the required direction of rotation of the motor, the reversing switch is locked and the lever can be moved without affecting the reversing switch. This intermediate movement which regulates the tank valves, allows the driver to alter the height of the liquid in the tank and so vary the speed of the motor. The reversing switch does not again come into action until the lever [illegible] up to the mid-position.

A point in the design of this starter to which special attention is drawn is that the rate of rise of the liquid in the tank and the corresponding [illegible] of the motor is fixed by the capacity of the [illegible] pump, so that the driver cannot possibly start otherwise than at a predetermined rate. This is [illegible] so that the motor will not start quicker than [illegible] suitable having regard to the overload [illegible] of the plant and the permissible stress [illegible] The practical result is that the equalised acceleration of the motor at starting, which is made independent of the [illegible] or skill of the driver, assures a steadier motion and more uniform stress, especially in the rope, than can be otherwise obtained.

STARTING AND CONTROLLER GEAR.

Braking is carried out in the same manner as with steam winders; the brake blocks are pressed down by means of the usual lever gear through steam or compressed air; and the adjustment takes place by means of a hand-lever, which permits of the brake pressure being altered as required. In order to [illegible] ascertain the position of the cages in the shaft a depth indicator with two spindles is erected in front of the driver. In the case of over-winding the indicator throws open the emergency switch and brings the brakes into action. On account of the very small distance separating the cage from the pulley gear, when the cage has arrived at the mouth of the shaft a special apparatus has been added, which automatically sets back the controlling lever if the driver has not done so in time. The lever however is not set back to its mid-position, that is current is not altogether switched off, but the speed is so reduced that when the depth indicator works on over-winding taking place the sudden braking is accomplished without shock.

In order to bring the winding motor automatically to rest in case of an accidental interruption in the circuit an electro-magnet is arranged to hold a weight up as long as current flows through the magnet winding; the moment this current is interrupted, the weight drops, actuates the compressed air brake and opens the emergency switch. Further in order that the driver may, in case of necessity, suddenly [illegible] a foot-step is provided, by means of which the [illegible] switch is opened and a weight [illegible] the brake blocks into action.

PUMPING PLANT

[illegible] plant consisted of an [illegible] erected directly over [illegible] The steam [illegible] diameter and the stroke [illegible] Working double-acting and with three strokes per [illegible] galls per minute [illegible] To equalise the weight [illegible] balancers each with a [illegible] The total weight [illegible] the wooden pump-rod [illegible] amounted to [illegible] long tons. [illegible] depth, an auxiliary [illegible] was driven by means of a continuous-current motor through double-reduction gearing.

The above machines were replaced by a modern electric Riedler "Express" pump erected underground, lifting 140 gallons per minute directly from the 2,400 ft. level. The pump, which was supplied by the "Gute Hoffnungshutte," Oberhausen, is of the single-crank type with differential working, the diameters being 4¾ in. and 5¼ in., the stroke 10 in. and the speed 160 revolutions per minute. In this pump, as is well known, the suction valve is closed by the plunger, whereas the delivery valves work automatically with spring control. To provide for the event of very impure water being pumped, the valves were constructed with special leather seatings. The pump is provided with bye-pass, as well as the necessary air chambers, etc. In view of the large head, a further large wrought-iron compressed-air vessel was also erected. A small electrically-driven compound compressor supplies the above air-vessel with compressed air.

The pump is direct-driven by a three-phase motor of 135 h.p. In order to be able to start under full head, the motor is provided with slip-ring rotor and water-starting resistance. The pump room lies under the down cast shaft, so that there is a constant circulation of cool air.

The shaft cables are of the three-core mine type with steel wire armouring, the cables being hung and secured in the shaft in the usual manner by means of wooden cleats.

VENTILATING

The existing ventilating plant consisted of a Capell ventilator rope driven from a steam engine at Shaft No. 8, and this was replaced by a direct-coupled 200 h.p. motor. This ventilator, running at 270 revolutions per minute, deals with 2,300 cubic feet of air, with a draught equivalent to 10 in. of water. When the old pumping plant is removed from Shaft No. 2, a second Capell ventilator will be erected to run at 330 revolutions per minute, and deal with about 2,100 cubic feet, with a draught of 8 in. The new ventilator is also to be driven by a 200 h.p. motor.

COAL HANDLING.

The coal raised from Shafts 9 and 12 is taken by means of small electric locomotives, which also bring back the empty wagons to Shaft No. 7.

By means of an endless chain all the loaded wagons are sent on from here to the screening plant, from whence the empty wagons are returned. For the driving of the chain, a motor of 25 h.p., running at 235 revolutions per minute, is employed, and the same motor drives another chain, which brings back the empty wagons to the mouth of Shaft No. 7. The screening plant is worked in the usual manner, and is driven by means of two 45-h.p. motors.

Part of the coal, after being sorted, is loaded into railway wagons, and brought by means of an electric locomotive to the station on the main line of the Belgian State Railway. The locomotive is of 110 h.p., and weighs approximately 27 tons; it is capable of conveying a train weighing about 230 tons along a maximum incline of 7 per cent. with a total tractive effort of 2·8 tons on the driving wheels. The maximum speed on the level is 11·2 miles per hour. The current is taken off by means of a trolley with special base frame, which readily adapts itself to the varying vertical and lateral

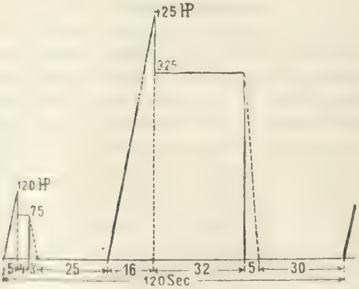


FIG. 6.

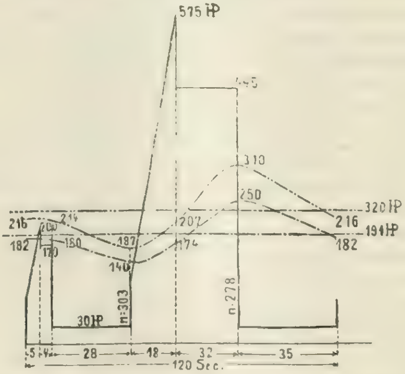


FIG. 7.

variations of the trolley wire. The driving motors consist of series-wound machines, 500 volts, 55 h.p., and on each of the two axles is mounted a motor with single reduction spur gear. The motors are run on the series-parallel system. For starting and regulating, a suitable controller is provided. The frame-work of the locomotive is built up of massive plate and angle iron, and is designed so as to allow of easy access to the motors. The driver's cab is arranged in the centre; in front and behind, housings, slanted off from the shed carry the controller resistance and the necessary ballast. The coal, other than that sent by railway, is brought by means of a wire-rope conveyor, driven from 23-h.p. motor, to the barges alongside the canal. In a similar manner, the earth and stone separated from the coal are taken off to the dumping grounds.

Two three-phase motors of 70 h.p. drive the workshops used in connection with the mines for the building of special machinery and apparatus, and two compressors each driven by a 70-h.p. motor are being supplied.

TELEPHONE INSTALLATIONS, ETC.

In order to be able to communicate at once between the power-station and the different supply points, both above and below ground, a telephone net-work, with loud-speaking telephones, has been installed. The signalling between the loading stages, the pit mouth, and the drivers of the winders, is likewise carried out electrically. Since May 1904, the power-station has been at work without interruption. In order that the changing over from steam to electricity should not interrupt the working of the mines it had to be done gradually.

Electrical winding began on Shaft No. 7 in June, 1904, and has only involved a total interruption of three days, including a Sunday. In a very short time, the drivers were completely *au fait* with the new system and very much prefer it now to steam winding on account of the easier handling and work. The electrical winder on Shaft 12 was put into service 1st April.

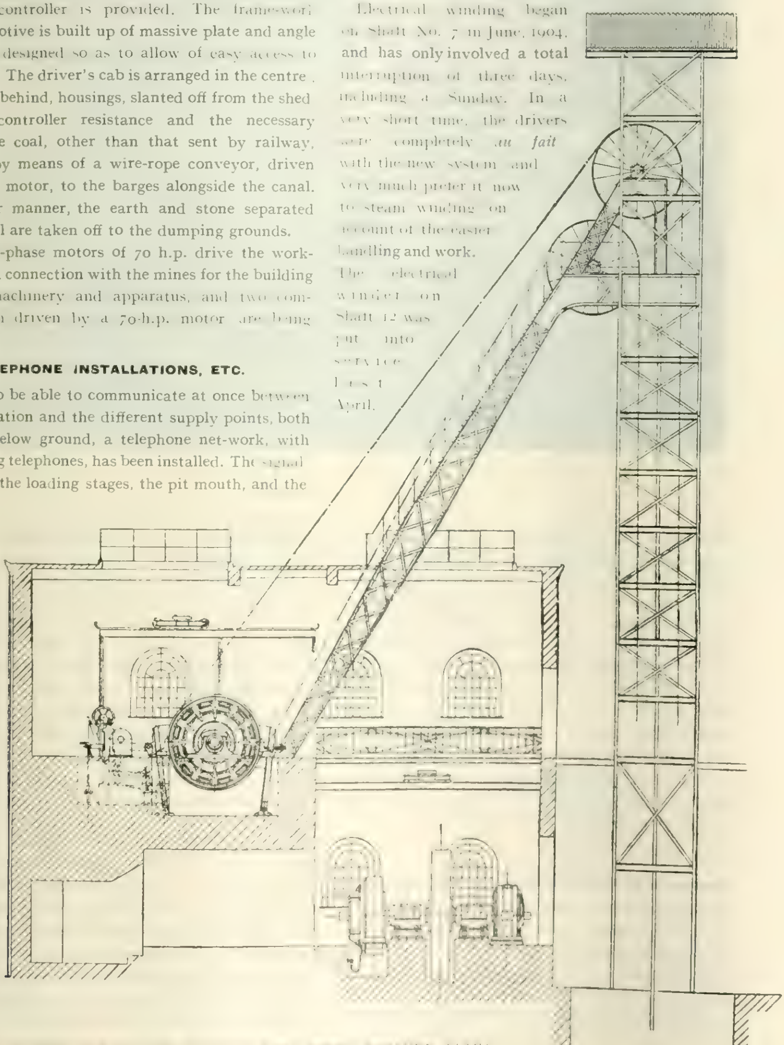


FIG. 8. ARRANGEMENT OF THE [illegible] PLANT.

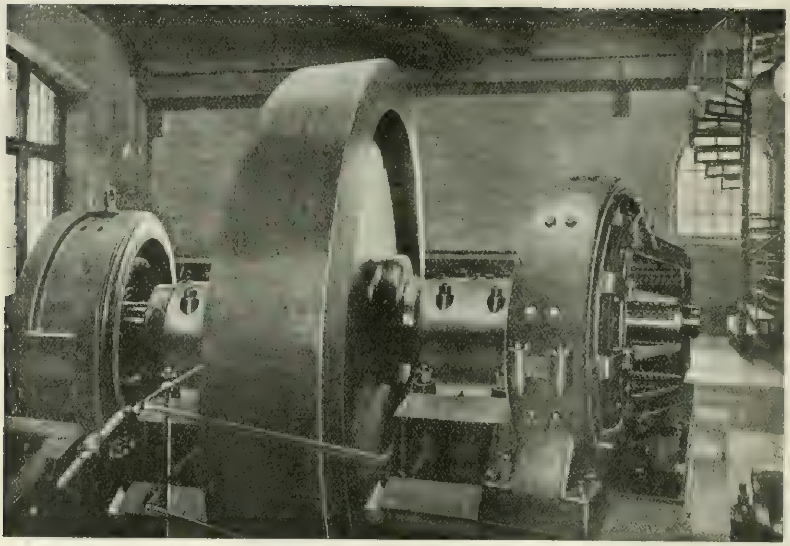


FIG. 9. ILGNER CONVERTER

Although it is not possible, until the scheme is completed, to give figures showing the complete actual working costs under the new system, all experience up to the present moment has shown that in addition to greater working safety and facility of control, a very great saving in wages and, above all, in fuel has been effected, so that in a few years through the savings in these items alone, the entire initial costs of the installation will have been paid off.

From diagrams taken by a recording wattmeter it is found that when hoisting normal load the current applied to the winder per efficient h.p. in coal lifted amounts to 1·[illegible] kilowatts, corresponding to a steam consumption of about 28 lb. per efficient h.p. in coal lifted.

"ESPERANCE ET BONNE FORTUNE" MINING PLANT.

As an addendum to the foregoing description of the [illegible] at Grand Hornu, where a complete new electrical plant [illegible] installed, and where the greater part of the energy [illegible] taken up by the winders, it will not be without interest to also consider shortly another electrical winder in Belgium where due consideration [illegible] given to an already existing electrical plant, as this will clearly show how the different conditions in each case require a different solution.

The "Societe Anonyme des Charbonnages l'Esperance et de Bonne Fortune" in Montegnée near Liege, owns three distinct coal mines, each with one winding shaft, Esperance, St. Nicholas, and Bonne Fortune.

The steam winder which had been in service at the St. Nicholas Pit for more than thirty years, working at a pressure of about [illegible] lb., required renewal. From the power-station at the Esperance Mine about 2,000 ft. distant, current was already taken for a ventilator, an auxiliary hoist, and also for lighting to the St. Nicholas Pit, for the new large coal washing plant, and for the transport, electrical driving had been adopted. It was therefore carefully considered whether it would not be well to also adopt electrical driving for the new winding plant to be laid down, thus enabling the boiler-house at the shaft to be done away with altogether, which of itself offered many advantages in consideration of the limited space available. After careful study of all the circumstances it was also shown that there would be a considerable saving in working costs [illegible] the electrical winder, as the existing steam winder was consuming no less than

115 lb. of steam per effective h.p. hour, a figure which had been confirmed by repeated experiments. The calculation of the new plant was based upon the following conditions: it was to be designed to ultimately lift 65 long tons per hour from 2,000 ft. depth with one stop per journey on an intermediate stage, and with each journey four tubs, containing 2·4 tons of coal, were to be raised. The existing depth amounted to [illegible] ft. with intermediate stages at depths of [illegible] and 540 ft. respectively. For the present [illegible] tons per hour were to be hoisted, later on it was to be also possible to work from a total depth of 2,600 ft. with smaller output.

The existing power-station situated at the Esperance Pit consisted of three direct-coupled sets each of 225 kilowatts, the steam-engine output amounting to 300 h.p. per engine. The working voltage was 1,000 v. and the frequency 44 cycles. Connected to the power-station were underground pumps at the Esperance and St. Nicholas pits, each of 125 h.p.; ventilators and sundry services absorbed another 250 h.p., so that altogether 250 h.p. was spare.

The current was conveyed to St. Nicholas by two three-wire overhead lines of bare copper conductors.

In order to ascertain in the present case what would be the most favourable system, two complete propositions were worked out on different lines. In one proposition direct driving by means of a three-phase motor, and in the other proposition a motor-generator to supply a continuous current winding motor, were proposed. Similarly the use of flat aloe fibre ropes with reels, as in the existing steam plant, and an alternative of steel ropes with Koepe pulley, were considered for each case.

The decision finally rested with the Koepe pulley, for the adoption of the latter permitted of the setting round of the winding plant, in reference to the shaft itself, by an angle of [illegible] deg. This course provided valuable space for erection of the new coal washing plant, and, in addition, enabled the winding plant to be laid down in a space otherwise useless.

In the choice of electrical system, it was necessary to take into consideration the fact that the winding height was comparatively small, and that on account of the stop at an intermediate stage, starting of the winding motor would have to take place twice per journey. Employing a three-phase winding motor, therefore, the loss in the starting resistance would be proportionately higher than if winding from a greater depth, and from the lowest stage only. The plant of the existing power-station would have no longer been sufficient to supply the necessary power at the starting and acceleration period of the winding [illegible] it would have become imperative to instal a further generator and to suitably extend the exciter plant in consequence, and the section of the transmission wires to St. Nicholas would not have been sufficient. The available frequency, of course, rendered it possible to connect directly a Koepe pulley with a three-phase motor, and for the use of such a direct-coupled three-phase winder the very great simplicity was a strong point in its favour.

Further study of the conditions however made it clear that the application of the continuous-current motor controlled by the Ward-Leonard system, for winding, combined with the motor-generator set offered a more favourable system of working and control in this case. By the adoption of this system, almost all starting-resistance losses are avoided, a point of great importance in view of the relatively small winding depth, and the necessity for stopping and starting twice per journey. The use of an interposed motor-generator set also rendered it possible to balance the fluctuating consumption of the winding motor by the employment of a flywheel working on the Ilgner system, the result being that the load on the

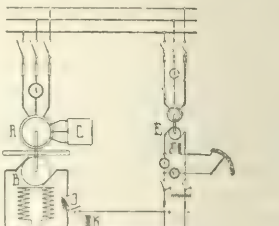


FIG. 10.

A. Three-phase Motor. B. Continuous Current Generator. C. Resistance for varying the "Slip" of the Motor. D. Winding Motor. E. Motor Generator [illegible]. F. Field Regulator of the Main Generator. G. [illegible] Switch in the Exciter Circuit of the Main Generator. H. Regulator for Weakening the Field of the Winding Motor. J. Maximum Cut-out and Emergency Switch. K. Electro-magnetic Brake.

power station would be almost uniform. In short, it was shown that the use of this system would enable the existing power-station to suffice for the immediate services in the mine, inclusive of the winding, whilst the overhead line to St. Nicholas would not have to be enlarged.

For all these reasons it was decided, in spite of the more complicated and more expensive arrangements of plant, to instal a continuous-current winding motor with a motor-generator set and flywheel, or so-called Ilgner converter, interposed between the three-phase supply mains and the winding motor.

For the ultimate winding requirements from 1,200 ft. depth, the conditions are as follows:

Effective load per journey ..	5,300 lb.
Weight of cage and attachments	4,000 ,,
Weight of the 4 tubs	2,200 ,,
Weight of flat wire rope, 3¾ in. by [illegible] in.	3·82 lb. per ft.
Diameter of the Koepe pulley ..	About 10 ft.
Winding speed	1,600 ft. p.m. (later to be 2,000 ft. p.m.)
Revolutions per minute of winder	51 (later to be 64).

The moment of inertia of the masses to be accelerated amounts to [illegible] ft. lb.

When on the lowest stage two full skips are loaded and at the [illegible] ft. stage the second deck of the cage is also loaded, the load diagram results as in fig. 6.

In the determination of the design of the converter set it was decided that, in order to control the speed of the converter and flywheel a fixed resistance should be inserted into the rotor circuit of the motor. Although the use of a variable resistance can control the power consumption from the three-phase mains so as to make the uniformity of the demand on the power-station still [illegible] it was decided against, in the present case, in order to avoid all unnecessary complications, and it was also shown that the maximum current demanded would be within the permissible limits for the primary generator plant.

Calculating that under the most unfavourable working conditions of the winding motor the maximum extent of the "slip" in the three phase converter motor [illegible] per cent. the working conditions for the converter are shown in the diagram fig. 7. The necessary moment of inertia amounts to 73,000 ft. lb. corresponding to a flywheel effect of about 15,000 ft. tons at [illegible] revolutions per minute.

In [illegible] dimensions of the flywheel it was [illegible] to exceed a diameter of 13 ft. in order to facilitate transport by railway, and the weight of the flywheel therefore resulted as 40 long tons.

In fig. 8 is shown the complete arrangement of the installation. As already referred to, the winding plant was set round 90 deg. from its previous position at the shaft. This also enabled the entire installation to be finished without disturbing the working of the previous steam plant. The original headgear was heightened without occasioning any interruption in the service and the new rope pulleys were arranged over the old ones. To allow for the altered direction of the stresses on the headgear two new strutts were erected.

The converter set itself was installed in an existing shed which had previously served as the engine-room for the old Cornish pumping plant and this also enabled the old foundations to be used with advantage. To receive the winding plant itself, the building was suitably lengthened and the foundations raised, in order that the driver might be in a position to see the pit-mouth, this being the usual practice in Belgium.

The shaft of the Ilgner converter (fig. 9) runs in two bearings on either side of the flywheel. The rotor of the three-phase motor, as well as the armature of the continuous-current generator overhang the shaft the bearings being of the oil-ring type with very large working surfaces, so that the pressure per unit of surface is kept as low as possible. White metal liners, cooled by means of water circulation are used.

The flywheel is of steel cast in one piece.

The synchronous speed is 330 revolutions per minute so that the maximum peripheral speed of the wheel amounts to 14,350 ft. per minute. The actual working speeds fluctuate according to the varying demands of the winding motor between 305 and 278 revolutions per minute.

The converter motor is of the induction type and is fitted with slip-rings; the stator resistance is of the liquid type with adjustable water height and is used both for the starting and speed regulation of the converter.

As a result of the use of the Koepe pulley, the winding plant is greatly simplified. The continuous current shunt wound winding motor being direct-mounted on the shaft of the Koepe pulley, only two bearings are necessary.

A single controller lever serves for the reversing of the motor as well as for the regulation of speed, and the gear is so designed that by setting out the lever in one direction the motor runs one way and by setting it back in the reverse direction the motor is likewise reversed. The further the lever is set out to one of the other side, the higher becomes the speed, and setting it back is followed by a reduction in speed, i.e., by electrical braking.

The arrangement of the mechanical brake is precisely the same as in the previously described winding plant for Grand Hornu, and the depth indicators and safety apparatus are also designed on similar lines. The brake acts by compressed air, which is supplied from a small compressor.

The continuous current necessary for excitation is generated from a separately installed motor-generator which consists of a 30-h.p. three-phase motor, direct, coupled to a 20-kilowatt continuous-current generator-the excitation pressure being 110 volts.

In consequence of the very heavy flywheel and the high speed, the converter would, if left to itself, continue to run on for 2½ hours, after all current has been cut off, before coming to rest. As it was desirable to be able to bring it to rest more quickly, an electro-magnetic braking device was fitted to the flywheel by means of which, through the action of eddy currents, induced in the rim of the wheel, the converter is brought to rest in 6½ minutes.

Fig. 10 shows clearly the connections of the installation. The mains from the power-station go to the bus-bars of the switchboard, from which the cables branch out to the various services. For the winding plant a second switchboard is erected, and, from the high tension bus-bars of this switchboard, the current goes through oil-switches and fuses to the three-phase motors of the Ilgner converter and auxiliary motor-generator for excitation.

The three-phase motor in the latter set has a pilot-wound rotor with automatic short-circuiting device, and therefore requires no special starting resistance.

The Ilgner converter is started by means of a liquid resistance which also serves for alteration of the "slip." The continuous-current generator on the shaft of the converter is a shunt-wound machine separately excited and its armature circuit is connected up directly with the armature circuit of the winding motor. When the winding motor is to start running the continuous current generator is excited, and, correspondingly as its voltage rises the speed of the winding motor rises. The winding speed of 2,000 ft. per minute corresponds to a terminal voltage of 500 volts. It will be seen that the control of the winding motor takes place by regulation of relatively small currents and the controller can therefore be of simple and light design. The winding motor remains permanently excited but the excitation is diminished when the motor is at rest, this taking place automatically by means of the driver's controller lever.

If, for any reason, the exciting current is cut off an electro-magnet arranged in the same circuit is de-energised; the magnet then releases a weight which brings the brake into action. The emergency switch which is actuated from the depth indicator, in the case of over-winding, is at the same time constructed as a maximum cut out and therefore interrupts the current when it rises beyond a pre-determined limit. In order, then, to also stop the winding motors, the magnet is de-energised at the same time by means of an auxiliary switch so that the brake acts. A footstep also permits of the release of a weight for operating the brake so as to serve as an emergency brake.

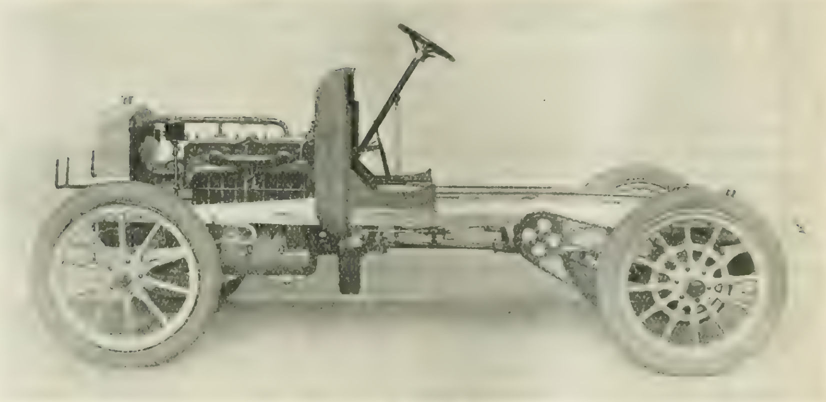
The installation has been at work since August, 1904 running day and night, and has continued without interruption of any kind. To replace the three existing steam-engines and generators, which, it is intended, will then act as spare plant, the directors of the mine have placed an order for a 750-kilowatt A.E.G. steam turbo-generator. To replace the two existing underground plunger pumps worked by geared electro-motors, an order for a high-lift Sulzer centrifugal pump has also been placed with the company. The pump, when running at 2,560 revolutions per minute will be able to lift 330 gallons of water per minute from a depth of [illegible] ft.

It is intended to undertake extensive experiments under working conditions both in the Grand Hornu and Esperance installations, which will clearly formulate the economical results obtained from the electrical working of these installations and the results of these experiments will be duly reported.

From a paper read before the South African Association of Engineers.

It is [illegible] that Mr. Vincent Hill, general [illegible] of the South Eastern and Chatham Company's Managing Committee, has been appointed [illegible] of the General Managers of the Railway Companies of Great Britain associated with the Railway [illegible] House.

The following have been admitted to the Institution of Mining and Metallurgy since October 12th, 1905: [illegible] Cooper, Mexico; Francis B. Jackson, [illegible], Tasmania; William F. [illegible] Reginald Francis, [illegible] S. Mari, Central America; Edwin [illegible], Helston; Charles E. [illegible]



30-40 H.P. DAIMLER CHASSIS.

INTERNATIONAL MOTOR EXHIBITION AT OLYMPIA.

(Continued from page 1162.)

DAIMLER MOTOR COMPANY.

BROADLY speaking the Daimler 1906 type cars incorporate no alterations of any moment. The engine has been little altered since last year. The two later designs, namely, 30-40 h.p. and 35-45 h.p., involve the same characteristics of design and manufacture as the 28-36 h.p. All are four-cylinder engines, the cylinders being cast in pairs with inlet and exhaust valves on one side, the valves being inclined to shorten the length of inlet and exhaust ports as well as to decrease the size and weight of the most important part of the engine, namely, the cylinder. The valve gearing, contrary to general practice, is exposed, and the use of this feature together with the inclined valves has been thoroughly justified by the experience of the last two years. The carburetter, which has won a reputation for giving economy in fuel consumption, has been slightly varied, and it is claimed that the company, in altering the system of coupling the throttle and ignition, has thus succeeded in making the timing of the ignition correct for all positions of the throttle, or in other words, for full power at all speeds.

We illustrate above the 30-40 h.p. chassis. The frame is built up as before of steel flitch plates, channel iron and wood, only slight alterations being made in the section and shape of the flitch plates and the nature of the cross members, which more securely tie the side members. The gear case, consisting of a combined form of cross-shaft and speed change gear box, is unaltered. The only modification in speed control introduced in the 1906 model is an efficient safety catch on the reverse lever, thus rendering it impossible for the driver to make use of a forward gear while the reverse is engaged. The brake system is constructed on exactly the same lines as before. The steering gear is of the worm and segment type, the only alteration effected in the 1906 model is in the quantity of material. The characteristic Daimler curved dashboard, radiator and engine bonnet remain unaltered.

The Daimler gear box is of a distinct type of its own, although it works on the usual sliding spur wheel principle, and has its sliding members controlled in much the same way as on a Mercedes car. The main differences are that the differential countershaft passes through the front instead of the back of the gear box, that the first motion shaft lies beneath the countershaft, and that the entire box is fixed to the main frame at three points only. Another feature is that the brake pedal of the car acts upon two brake drums that are fitted just inside the sprocketwheels on the countershaft instead of upon the shell of the differential-gear, and that thus the entire gear can run in an oil-tight casing, which extends right along the countershaft up to the braked-rums. We give a view on page 1172 of the change-speed arrangement which shows both levers in the neutral position. There is also shown a view of the 28-36 h.p. Daimler engine.

NEW ARROL-JOHNSTON CAR COMPANY.

An interesting group of exhibits is shown by this company. In the heavy vehicle section there is shown a 12-15 h.p. van or lorry suitable for carrying loads up to 30 cwts. and a 24–30 h.p. double decked omnibus to carry 16 passengers inside and 20 outside. In the car section five models are on view including the 18 h.p. new Arrol-Johnston car which won the International Tourist Trophy Race in the Isle of Man in September last.

The cars manufactured by the company are built under the "Arrol-Johnston" patents and are the result of a series of exhaustive experiments begun in [illegible].

In designing the cars no attempt has been made to produce a light, semi-racing pleasure car suitable only for good roads and fair weather. Nothing has been sacrificed to the attainment of an excessive rate of speed.

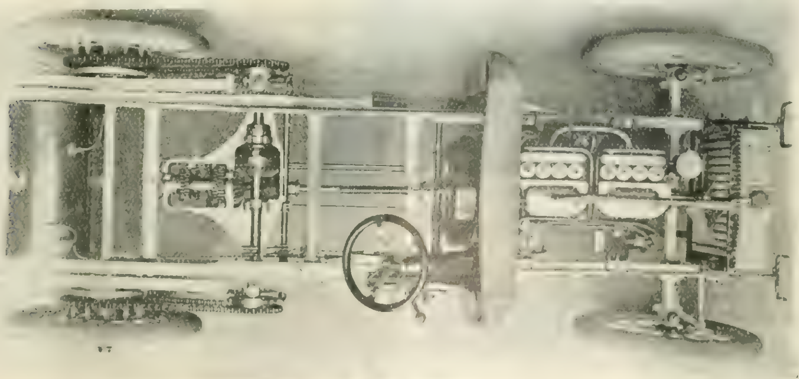
The engine of the 24–30 h.p. selected as a type, is of the four cylinder vertical type which runs at a normal speed of 950 revolutions per minute and at this speed gives 24 h.p. on the brake. It is constructed so that all the working parts are completely enclosed and run in oil tight casings. All the gear wheels for driving cam shaft, water pump and magneto are completely enclosed, but on removing an aluminium cover are easily inspected.

The cam shaft and cam casing are so constructed that they can be removed in one piece for inspection. The cylinders are cast separately. The cylinder head and valve chest is not cast with the cylinder but is attached thereto by six studs.

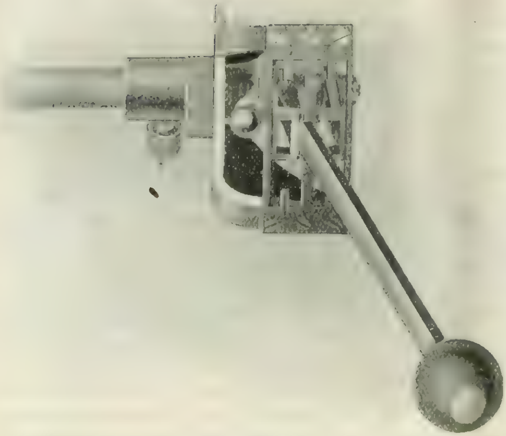
The inlet valve is placed over the exhaust valve, thus allowing of a minimum wall surface to a maximum compression space, an important point in the economical running of a petrol engine and one often ignored. The crank case is of a special alloy of aluminium giving great strength.

The crank shaft is machined from a solid forging of specially selected nickel steel. All the main bearings are ground and the cam shaft is made from a solid piece of tool steel.

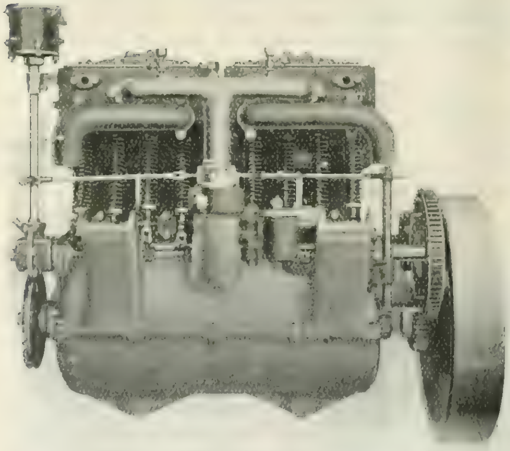
The governor is a patented type and is adjustable at will. It is operated by the varying suction caused by the engine, the speed being capable of variation from 200 to 1200 revolutions per minute. Governing by hand is also arranged for by means of a very simply arranged throttle valve, which not only throttles the mixture but alters its quality at will. Further, when the engine is used as a brake it admits pure air to the cylinders, allowing them to be thoroughly scavenged when the car is descending inclines and thus preventing lubricating oil being drawn into the combustion chamber by the vacuum formed by the engine when the usual method of throttling is employed.



PLAN OF 30-40 H.P. [illegible] CHASSIS.



DAIMLER CHANGE-SPEED, SHOWING LEVERS IN NEUTRAL POSITION.



28-36 H.P. DAIMLER ENGINE.

The engine is lubricated by means of a force pump on the same system which is successfully used in modern high speed steam engine practice.

A feature of the car is that the clutch which is of the three-shoe metal to metal type. It is so arranged that there is no end thrust on the crank shaft.

This clutch, by its gentle action, does not strain the gears or tyres thereby increasing their life.

PERMAN AND CO., LTD.

Among other exhibits this firm is showing the "Kromhout" petroleum motors, and the "Iris" British marine set.

The "Kromhout" motor has been designed for use in commercial vessels.

The engines are designed and manufactured by Messrs. D. Goedkoop Jr. of Amsterdam.

In the first competition in this country in which the "Kromhout" was entered—the Motor Yacht Club's reliability trials, at Southampton, in August, 1905, it was awarded the gold medal for its class, and the Autocar challenge cup for the most meritorious performance, irrespective of class, price and power.

The motor is of the vertical four cycle type running at a slow speed. The motor is self contained, the reversing gear and thrust bearing being fixed to the same casting as the crank case. The motor has been constructed with a view to heavy marine work. The bearing surfaces throughout are of exceptional length. It has no carburetter or generator, but only a simple inside vaporiser seated directly under the inlet valve, from which position it can be easily removed for cleaning. To start the motor a small quantity of petrol is used; when this is consumed the vaporiser is hot enough to run the engine on paraffin. The paraffin is forced into the cylinder by means of a small plunger pump driven off an eccentric on the two to one shaft.

The governor is of special design, and is so constructed that when the governor is not in action the exhaust valve is lifted at every second revolution of the motor. The chief features claimed for the governor are its extreme simplicity and the fact that it is impossible for the sharp edges of the valve lifter and slide piece to come together, a fault apparent in some types of pendulum gear.

The "Iris" is a purely marine motor, the engine, the forward-reverse gear and the control having been designed for marine work, and not being, as is frequently the case, a motor-car set, adapted to boat work. It is of British manufacture, being built by Messrs. Legros and Knowles, Ltd. The engine, of the four-cycle internal combustion type developes 24 h.p. at 750 revolutions per minute, and is claimed to give a large torque over the whole range from 130 revolutions per minute to 1,000 revolutions per minute.

The feet three on each side by which the engine is bolted to the bed plate frame, form strong hinges, so that by removing the hinge bolts on one side, the complete engine can be swung over to the other side. The lower half of the base chamber is then easily removable, immediately exposing the crankshaft bearings, the big end bearings, and all the working parts of the engine, for inspection and adjustment. Each individual brass can be removed separately without disturbing the crankshaft or any other part.

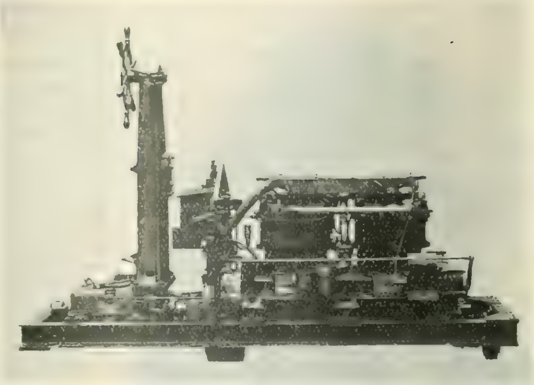
The crankshaft is of selected nickel steel of high tensile strength, machined to 1-1000 in. from a solid forging.

One camshaft carries all valve cams, and the high tension ignition commutator; the other camshaft carries magneto ignition cams and advance movement. The camshafts are carried in separate camshaft cases, mounted on the upper portion of the upper half of base chamber. The camshaft cases are entirely closed in, and it is possible to easily remove the whole of either camshaft with its casing and pushers and guides without disturbing any other part of the engine.

The two-to-one gear is carefully designed and proportioned. It is carried on the front end of the engine, where it is immediately accessible. The gearing is entirely cased in, but the casing is easily dismounted without disturbing any other part.

All bearings have very large surfaces, and have been carefully designed to give a large margin above the necessary calculated area.

The engine has been designed and constructed so that it may be run either with petrol or paraffin as fuel. Petrol is, of course, more efficient fuel than paraffin, the efficiency of an engine depreciating approximately [illegible] five per cent. when paraffin is used.



24 H.P. "IRIS" MARINE SET.

The "Iris" motor boat, fitted with this engine, ran in the Motor Yacht Club's reliability trials last July, and showed great seaworthiness. She was the only forty-footer which could be driven through the rough seas at her full speed of [illegible] knots. She has been tried repeatedly since, and has made several noteworthy non-stop runs—notably one from Southampton to the Thames.

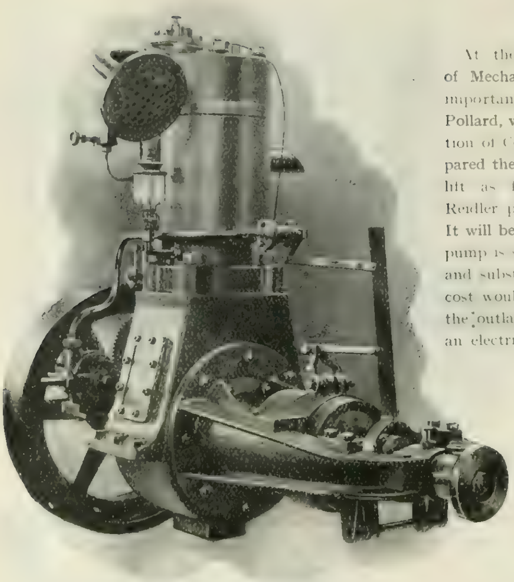
MITCHAM MOTOR COMPANY, LTD.

[illegible] exhibits [illegible] cabin cruising launch. The dimensions are 30 ft. by 7 ft. 6 in. beam by 3 ft. 9 in. depth, and the boat should give a maximum of accommodation [illegible]. The engine is a double cylinder Mitcham [illegible] motor. A half section of [illegible] Mitcham [illegible] engine is shown [illegible]. [illegible] include the sizes most [illegible] h.p. single and 4 h.p. [illegible] single cylinder motor, [illegible] t-launch. Another [illegible] h.p. motor fitted with [illegible].

VAUXHALL AND WEST HYDRAULIC ENGINEERING COMPANY

[illegible] the [illegible] and [illegible] attracted the attention [illegible] work.

[illegible] cylinder balanced vertical [illegible] bore by 4¾-in. stroke, [illegible] normal speed of [illegible]



12 H.P. KROMHOUT ENGINE.

revolutions. The inlet and exhaust valves are mechanically operated and of large area, all interchangeable.

The clutch is of special design and extremely sensitive, an auxiliary clutch being brought into action before the main clutch takes hold, thus relieving the car of sudden strains. It is so arranged that there is no end thrust on shafts. The carburetter is of the float feed, constant level type.

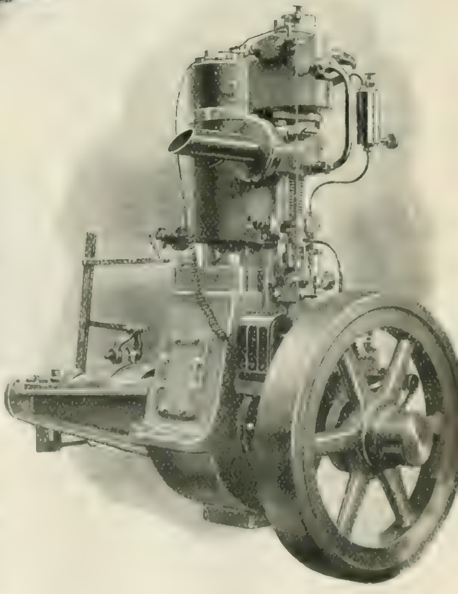
The governor fitted is of the centrifugal form, operating on the variable lift gear of the inlet valves and so adjusted as to ensure freedom from hunting.

The transmission gear has four speeds forward and one reverse, all worked by one lever, so arranged that any speed can be reached from the neutral position without passing through other speeds, and vice versa. The sliding sleeve type of change speed gear is used with direct drive on the top speed. Two universal joints are placed between the clutch shaft and the gear box to relieve the shafts of any strain caused by road shocks.

The steering gear is of the irreversible worm type, the steering wheel being placed at a much greater rake than usual to ensure easy steering.

DEEP LEVEL PUMPS.

At the last meeting of the Transvaal Institute of Mechanical Engineers a paper was read on an important subject, that of deep level pumps. Mr Pollard, who read the paper did not advise the installation of Cornish pumps in deep level mines. He compared the costs of three kinds of pumps for a 2,000 ft. lift as follows:—Cornish pump £100 7s.; two Riedler pumps, £104 10s.; two electric pumps £92. It will be noted that the cost of operating the electric pump is slightly less than that of the Cornish pump, and substituting Kaffirs at £4 in place of coolies the cost would be reduced to £54. In the Cornish pump the outlay on machinery, etc., is £4,300, whereas for an electric installation the outlay is only £3,016, and the operating and other costs are in favour of electric pumping. No charges on prime movers have been taken into account.



12 H.P. KROMHOUT ENGINE (ANOTHER VIEW).

THE TECHNICAL LIBRARY.

BIBLIOGRAPHY No. 2.—ELECTRICAL WORKS (*Continued*).

ELECTRIC TRACTION, CENTRAL STATIONS, ETC.

Ashe, S. W. and Keiley, J. D. Electric Railways, Theoretically and practically treated. 10s. 6d. net. New York: D. Van Nostrand and Co. London: Archibald Constable.

Bell, L., Ph.D. Power Distribution for Electric Railways. 8vo. cloth. With 139 illustrations. 10s. 6d. net. Spon.

Clark, D. K., M.Inst.C.E. Tramways: Their Construction and Working. Embracing a Comprehensive History of the System; with an exhaustive Analysis of the Various Modes of Traction, including Horse Power, Steam, Cable Traction, Electric Traction, etc. New edition, thoroughly revised, and including the Progress recently made in Tramway Construction, etc., etc. With 400 illustrations. 8vo, 780 pp., buckram, 28s. Crosby Lockwood.

Dawson, P., C.E. Electric Railways and Tramways: Their Construction and Operation. A practical handbook. 700 pp. 503 diagrams and working drawings. Enlarged. Demy 4to, half-bound, £2 2s. net. Whittaker.

Dawson, P., C.E. Electric Traction. A practical Pocket-book of Rules, Formulæ, Diagrams, and Tables for Electrical Engineers, on the Construction and Maintenance of Electric Railways and Tramways. Fcp. 8vo, leather. 17s. 6d. net. Whittaker.

Gay, A., and Yeaman, C. H. Central Station Electricity Supply. With 300 illustrations. By A. Gay. Crown 8vo, cloth. 10s. 6d. net. Whittaker.

Gibbings, A. H., M.I.E.E. Electricity Supply, Commercial and Business Aspect of. A practical handbook for the use of Municipal Electrical Engineers and Members of Municipal Electricity Committees. Post 4to. 6s. Whittaker.

Hanchett, G. T., M.E. Electric Railway Motors. With 140 illustrations. 8vo, cloth. 8s. 6d. net. Spon.

Hay, Professor Alfred, D.Sc., M.I.E.E. Alternating Currents. Their Theory, Generation, and Transformation. Demy 8vo. Profusely illustrated. 6s. net. Harpers.

Hering, C. Electric Railways, recent Progress in. 390 pp., and 104 illustrations. 5s. Spon.

Hedges, K. American Electric Street Railways: their Construction and Equipment. 200 illustrations, post 4to. 12s. 6d. Spon.

Herrick, A. B. Practical Electric Railway Handbook. Bound for the pocket, with flap. Numerous illustrations. 450 pp. 15s. New edition in preparation. Spon.

Langdon, W. E. Application of Electricity to Railway Working. 142 illustrations. 8vo. 10s. 6d. Spon.

Merrill, E. A. Tables and Formulæ for Electric Street Railway Engineers. Leather. Pocket size. 4s. 6d. net. Spon.

Parshall, H. F. and Hobart, H. M. Electric Traction Engineering. Fully illustrated. A. Constable.

Rider, J. H., M.I.E.E., M.Inst.C.E. Electric Traction. A practical handbook on the Application of Electricity as a Locomotive Power. With numerous illustrations. Crown 8vo. 10s. 6d. net. Whittaker.

Smith, R. H., Assoc. M.I.C.E., M.I.Mech.E., M.I., etc. Electric Traction. 9s. net. Harpers.

Whyte, Gowans A., B.Sc., The Electrical Industry. Lighting, Traction, and Power. 2s. 6d. net. Methuen.

Wilson, E., Whit. Sch., M.I.E.E. Electrical Traction. New edition, re-written and greatly enlarged. Demy 8vo. In preparation. Edwin Arnold.

Wordingham, C. H., A.K.C. Central Electrical Stations: Their Design, Organisation, and Management. Second edition. 24s. net. Griffin.

ELECTRICAL TRANSMISSION, DISTRIBUTION AND CONTROL.

Abbott, A. V., C.E. The Electrical Transmission of Energy. A Manual for the Design of Electrical Circuits. With ten folding diagrams and sixteen full-page engravings. Fourth edition, entirely re-written and enlarged. Royal 8vo, cloth. 30s. net. Crosby Lockwood.

Andrews, Leonard. Electricity Control. A Treatise on Electric Switchgear and Systems of Electric Transmission. 12s. 6d. net. Charles Griffin.

Atkinson, P., A.M., Ph.D. Power Transmitted by Electricity, and applied by the Electric Motor, including Electric Railway Construction. Third edition, fully revised, and New Matter added. With 94 illustrations. Crown 8vo, cloth, 9s. net. Crosby Lockwood.

Bedell, F., Ph.D. The Principles of the Transformer. 8vo. 13s. net. Macmillan.

Bell, L., Ph.D. Electrical Power Transmission. A practical Treatise for Practical Men. With 300 illustrations. New edition in preparation. Spon.

Bowker, W.R., C.E., M.F., E.E. Dynamo, Motor and Switchboard Circuits for Electrical Engineers. A practical book dealing with the subject of Direct, Alternating and Polyphase Currents. 8vo, cloth. 6s. net. Crosby Lockwood.

Clinton, W. C., B.Sc. (Lond.) Electric Wiring. A Primer for the use of Wiremen and Students. With 80 illustrations and a selection of Work Examples. Fcp. 8vo. 1s. 6d. John Murray.

Crapper, E. H., M.I.E.E. Electric and Magnetic Circuits. viii + 380 pages. Demy 8vo. 10s. 6d. net. Edwin Arnold.

Electrical Engineers, Institution of General Rules recommended for Wiring for the Supply of Electrical Energy. 8vo, sewed, 6d.; cloth 1s. net. Spon.

Emmet, W. le Roy, M.Am.I.E.E. Alternating Current Wiring and Distribution. 5s. Spon.

Houston, E. J., Ph.D., and Kennelly, A. E., D.Sc. Alternating Electric Currents. With 77 illustrations. 4s. 6d. net. Spon.

Krause, Rudolf. Starters and Regulators for Electric Motors and Generators: Theory, Construction, and Connection. Translated by C. K. [illegible], A.M.I.E.E., and N. West, A.I.E.E. Demy 8vo. Profusely illustrated. Price 4s. 6d. net; 4s. 10d. post free. Harpers.

Kapp, Gisbert, C. E., M.Inst.E.E. Electric Transmission of Energy, and its Transformation. Subdivision, and Distribution. Fourth edition, mostly re-written. With 166 illustrations. Crown 8vo. 10s. 6d. Whittaker.

Lodge, Sir Oliver, F.R.S., LL.D., Lightning Conductors and Lightning Guards. A Treatise on the Protection of Buildings, of Telegraph Instruments and Submarine Cables, and of Electric Installations generally, from damage by Atmospheric Discharges, with numerous illustrations. Crown 8vo. 15s. Whittaker.

Maycock W. P., M.I.E.E. The Alternating-Current Circuit and Motor. An Introductory and Non-Mathematical Book for Engineers and Students. Second edition. Revised. With 143 illustrations. 4s. 6d. net. Whittaker.

Perrine, F. A. C., A.M., D.Sc., Conductors for Electrical Distribution. Their Materals and Manufacture, The Calculation of Circuits, Pole-line Construction, Undergrouud working, and other uses. 8vo, cloth. 20s. net. Crosby Lockwood.

Schneider, N. H. Electrical Circuits and Diagrams. Contains 217 diagrams of Connections. Comprising Alarms, Automobiles, Motors, Telephones, etc. Price 1s. 6d. net; post free, 1s. 7½d. Spon.

Solomon, H.G., Electric Meters. A treatise on meters for all purposes, in large 8vo. Handsome cloth. Profusely illustrated. Griffin.

Turner, H. W., M.I.E.E. and Hobart, H. M., M.I.E.E. Insulation of Electric Machines. With 162 illustrations. 10s. 6d. net; post free, 11s. Whittaker.

Vaughan, A. A., C.E. The Electrical Transmission of Energy. 1 vol. demy 8vo. With illustrations and diagrams. 25s. net. Sampson Low, Marston.

ELECTRIC LIGHTING.

Allsop, F. C. Practical Electric Light Fitting. Sixth edition. With 242 illustrations. 5s. Whittaker.

Bell, Louis, Ph.D. The Art of Illumination. Demy 8vo, 345 pp. Fully illustrated. 10s. 6d. net. A. Constable.

Crocker, F. B. (New York). Electric Lighting: A Practical Exposition of the Art. Vol I., The Generating Plant. Royal 8vo. 12s. 6d. net. Vol. II., Distributing Systems and Lamps. Royal 8vo. 12s. 6d net Spon

Heaphy. M. The Phœnix Fire Office Rules for Electric Light and Electrical Power Installations. Twenty-sixth edition, 8vo, sewed. 6d. Spon.

Houston, E. J., and Kennelly, A. E., D.Sc. Electric Incandescent Lighting. With 146 illustrations 4s 6d. net. Spon.

Houston, E. J., and Kennelly, A. E., D.Sc. Electric Arc Lighting. With 153 illustrations 4s 6d net. Spon.

Knight, J. H. Electric Light for Country Houses. Third edition, revised. Crown 8vo, wrapper. 1s. Crosby Lockwood.

Merrill, E. A. Electric Lighting Specifications. For use of Engineers and Architects. 6s. 6d net. Spon

Maycock, W. P., M.I.E.E. Electric Wiring, Fittings, Switches, and Lamps. A practical book for Electric Light Engineers, Wiring and Fitting Contractors, Consulting Engineers, Architects, Builders, Wiremen and Students. Third edition, revised. With [illegible] illustrations. 6s. Whittaker.

Maycock, W. P., M.I.E.E. Electric Wiring Tables. A collection of original and carefully verified Tables for the use of Electrical Engineers. Second edition, revised. Waistcoat pocket size. Leather, gilt edges. 3s. 6d. Whittaker.

Maycock, W. P. Electric Wiring and Fitting Details Forms. A book of 100 Forms for Electric Wiremen and Fitters. Oblong, cloth. 2s. 6d. net; postage. 5d Whittaker.

Maycock, W. P., M.I.E.E. Electric Lighting and Power Distribution. An elementary Manual for Students preparing for the Preliminary and Ordinary Grade Examination of the City and Guilds of London Institute. Sixth edition, revised. Vol. I., with 231 illustrations. 6s. Vol. II., with 400 illustrations. 7s. 6d. Whittaker.

Metcalfe. Charles C., A.M.I.E.E. Practical Electric Wiring for Lighting Installations. Suitable for Foremen, Wiremen, Students, and for all those who wish to acquire a practical knowledge of Wiring, Jointing, and Fitting, for the Installation of the Electric Light. 5s. net. Harper.

Russell, S. A., Assoc. M.Inst.CE., M.I.E.E. Electric Light Cables and the Distribution of Electricity. Second edition, revised. With 110 illustrations. 10s. 6d Whittaker.

Salomons, Sir D. Electric Light Installations. Vol. I.—Accumulators. Ninth edition. With 36 illustrations. 6s. Vol. II.—Apparatus. With 305 illustrations. Eighth edition. 7s. 6d. Vol. III.—Application. With 32 illustrations. 5s. (New edition preparing.) Whittaker.

Scrutton, Percy E. Electricity in Town and Country Houses. Third edition. Crown 8vo. Fully illustrated. 2s. 6d. A Constable.

Slingo, W. and Brooker, A. Electrical Engineering for Electric Light Artizans and Students. With 383 illustrations. Crown 8vo. 12s. Longmans.

Swinton A. A. C., M.Inst.C.E. Electric Lighting (Elementary Principles of). Fifth edition. With 16 illustrations. Crown 8vo., cloth. 1s. 6d. Crosby Lockwood.

Taylor, F. H., A.M.I E.E. Private House Electric Lighting. Describes modern methods in Wiring and Fitting, including a chapter on Small Generating Plants. 1s. Postage 3d. P. Marshall.

Urquhart, J. W., Electric Light. Its Production and Use, embodying Plain Directions for the Treatment of Dynamo-Electric Machines, Batteries, Accumulators, and Electric Lamps. Seventh edition. Crown 8vo, cloth. 7s. 6d. Crosby Lockwood.

Urquhart, J. W., Electric Light Fitting. A Handbook for Working Electrical Engineers, embodying Practical Notes on Installation Management. With numerous illustrations. Fourth edition, revised Crown 8vo, cloth. 5s. Crosby Lockwood.

SHIP LIGHTING, ETC.

Larkin, A. E., and Lindsay, A., Brown's Marine Electrician. Containing Concise Information and Practical Hints on the Installation and Maintenance of Electric Plant for Sea-going Engineers. 3s. 6d. net. Brown and Son.

Urquhart, J. W., Electric Ship Lighting. A handbook on the Practical Fitting and Running of Ships' Electrical Plant. [illegible] edition. With 88 illustrations. Crown 8vo, cloth. [illegible] Crosby Lockwood.

Walker, Electric Lighting for Marine Engineers. Second Edition. With 103 Illustrations. Crown 8vo. 5s. Whittaker.

(To be continued.)

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day

Ebbw Vale (Mon.)—The following for the Urban District Council: (Section E) tree wiring; (F) supply of incandescent lamps. Mr. Reginald P. Wilson, Consulting Engineer's Office, Ebbw Vale ... Nov. 25

Saffron Walden, Essex.—Supply and erection complete of four benches of deep regenerator settings containing six retorts each 10 ft. long 22 in. by 16 in. oval ⌓'s, with self-sealing lift, complete with hydraulic main ascension pipes, etc., also with overhead girder carrying travelling chain pulley and scoop charging gear; two of the above benches only to be erected during 1906, and the remaining two at a later period. Also for supply and erection complete of a half-ton sulphate of ammonia plant with building to be left in working condition, for the Gas Undertaking Committee. Mr. A. H. Forbes, gasworks manager, Saffron Walden ... ... Nov. 27

Dublin.—Reconstruction of bridges for the Great Northern Railway Company (Ireland). Also construction and erection of steel principal platform roof, 97 ft. by 17 ft., with cast iron columns, for Ballybay station. Mr. W. H. Mills, engineer-in-chief, Amiens-street, Dublin ... ... Nov. 27

Burton-on-Trent. — Construction, delivery and fixing of No. 2 Lancashire boilers, 20 ft. by 6 ft. 6 in., including all mountings, at the Public Baths. Mr. George T. Lynam, Borough Engineer and Surveyor, Burton-on-Trent... ... ... Nov. 29

Ingatestone (Essex).—Making, delivering, setting to work, and maintaining in good order for six months at the waterworks pumping station, Ingatestone, Essex, of one horizontal gas-engine, with suction gas-producer plant; one two-throw deep-well pump of 5,000 gallons per hour capacity; two sets of treble-ram force pumps, each of 5,000 gallons per hour capacity; also for taking out and altering a borehole pump, and removing and refixing an oil engine, together with all necessary gearing, pipes, valves, and fittings, for the Chelmsford Rural District Council. Office of Engineer, Chelmsford, Essex ... ... Dec. 1

Sleaford.—Supply and fixing of a water-wheel and pumps complete capable of raising 1,800 gallons of sewage per hour, gross lift 8ft. 6in., with 7,400 cubic feet of water per hour, 6ft. head, for the Sleaford Urban District Council. Mr. Jesse Clare, surveyor, Sleaford . — ... Dec. 2

Last Day.

Dublin.—Supply of six steam rail motorcars for the Great Northern Railway Company. Mr. T. Morrison, secretary, Amiens Street Terminus, Dublin ... ... Dec. 4

Widnes.—Supply and erection of a triple-expansion engine, with 20-in. deep bore-hole and force pumps capable of discharging 3,000,000 gallons per diem against a total head of 500 ft., for the Widnes Corporation. Mr. Isaac Carr, M.Inst.C.E., Widnes ... ... Dec. 5

Bristol.—Construction, delivery, erecting in place, and maintenance for twelve months after erection of Fender Chains for the entrance lock to the Royal Edward Dock now in course of construction at Avonmouth, in the Port of Bristol. Secretary, Docks Committee, 19, Queen Street, Bristol... ... ... Dec. 7

COMING CONTRACTS.

Pontypridd.—The Pontypridd Corporation have received sanction from the Local Government Board to the borrowing of £18,000 for tramway purposes.

Newton Abbot.—The Local Government Board have sanctioned the borrowing by the Urban District Council of £7,000 for purposes of a sewerage scheme.

Skipton.—The Local Government Board are prepared to sanction the scheme of sewage disposal designed by the engineer and surveyor to the Council, Mr. John Mallinson, subject to slight alteration as to size and position of the storm-water filter and the omission of a storm-water overflow. The scheme is estimated to cost £12,500.

France. — Preliminaries for the construction of a line to connect the French southern and central lines with the new Simplon route have been settled. The P. L. and M. R. will expend £200,000 on rolling-stock and stations.

Hull.—The city engineer, in a report to the Council, recommended the erection of a pier in front of the Western Reservation at a cost of £215,000. As an alternative scheme, he recommended the construction of a floating landing stage, a wharf on the river embankment, four bridges connecting landing stage and wharf, and other works at an estimated cost of £275,000. The first scheme has been adopted.

Liverpool.—A proposal to expend £14,000 on underpinning the southern portion of the Canada Tongue, and to deepen a portion of the dock opposite, will come before the next meeting of the Mersey Docks and Harbour Board.

Gravesend.—The Town Council has applied to the Local Government Board for a loan of £7,000 for the provision of a 300 kw. steam generator to deal with the tramway load, and to supply for lighting purposes, if desired.

Newquay. Arrangements have been made to proceed with the erection of the generating station and the laying of the mains through the streets forthwith, for the electric lighting of the town.

Hammersmith. The Council have just decided to apply to Loadon County Council for sanction to a loan of £15,570 for mains and sub-stations (£7,868 12s. 8d.), consumers' services (£3,599 4s. 9d.), and buildings (£4,103).

Bournemouth.--It has been decided to proceed with the scheme for a line from Bournemouth to Swanage, which is estimated to cost £200,000.

CONTRACTS CLOSED.

Liverpool.—Messrs. Elder and Company, of Liverpool, have just contracted with Harland and Wolff, of Belfast, for four large combined freight and passenger steamers.

Middlesbrough.—Bolckow, Vaughan and Company, Ltd., Cleveland Steel Works, Middlesbrough, have lately secured a contract for the early delivery at Bombay of several thousands of tons of heavy steel rails required for the Great Indian Peninsular Railway.

Taunton.—Messrs. Newtons, Ltd., of Taunton, have lately received from the Government repeat orders for dynamos, consisting of two 100-k.w. steam driven sets, and two 50-k.w. steam driven sets.

London.—The Brush Electrical Engineering Company have received the following contracts: Dunlop Rubber Company, Birmingham, 300-k.w. steam engine direct coupled to alternator; North-Eastern Railway, 200 truck frames; South Metropolitan Traction Company, for Penge extension, 16 double-deck cars, complete with trucks and motor equipments; South Metropolitan Traction Company for Mitcham extension, 16 double-deck cars, complete with trucks and motor equipments, and Mansfield Light Railway (for British Westinghouse Company), six double-deck cars, with top covers and four-wheel trucks.

Grove. The Metropolitan Asylums Board have placed an order with Pritchetts and Gold, for renewing, the storage battery at Grove Hospital.

Sheffield.—Mellowes and Co., Ltd., of Corporation Street, Sheffield, have recently been favoured with the orders for glazing with their "Eclipse" patent imperishable system the roofs of:—New car sheds, Derby; Glasgow University; H.M. Dockyard, Devonport; extensions of works for Cammell, Laird and Co., Limited, Sheffield; North British Locomotive shops, Glasgow; Beardmore and Co., Limited, Glasgow.

Stalybridge. The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board have accepted the tender of W. T. Glover and Co. for supply of cable.

Wellington (N.Z.). The Corporation tramways department have placed an order with Belliss and Morcom for a high-speed triple-expansion 1,000 h.p. steam engine. The Electrical Construction Company have received an order from the Wellington Council, New Zealand, for the supply of power-house apparatus to the extent of £9,4[illegible].

Belfast.—Pollock and MacNab, Ltd., Bredbury, near Manchester, have received an order for drilling machines from the Belfast Corporation.

Glasgow. The Tramways Committee have let the following contracts:—India Rubber Company, insulated cable; P. and W. McLellan, special track work; Alfred Herbert, Ltd., machine dies; B. and S. Massey, pneumatic power hammers; Estler Brothers, trolley standards and poles; Fleming, Birby and Goodall, graphite bushings; Loram Steel Company, special track work for Albert Road; Craig Sharp, Ltd., bitumen; Currie & Co., rock asphalte; Howard Conduit Company, conduits; Dempster, Moore and Co., anvils, &c.; Spear and Jackson, cold saws.

APPOINTMENTS VACANT.

Birmingham.—At the University of Birmingham a mechanical draughtsman is required, thoroughly conversant with best English practice in the design of dynamos, transformers, and accessory apparatus. Salary £250 per annum. The Secretary Nov. 27

India.—The Bombay, Baroda and Central India Railway Company invite applications for appointment as assistant engineer in the Way and Works Department in India. Two appointments will be made. Salary, Rs.350 per calendar month. Mr. T. W. Wood, secretary, Gloucester House, Bishopsgate Street Without, London, E.C. Nov. 30

Trowbridge.—The Urban District Council require an experienced working mechanical engineer to take charge of sewage pumping station. Mr. H. J. Nicholson, Farley Town Hall, Trowbridge ... ... Dec. 7

APPOINTMENTS FILLED.

Admiralty.—Mr. J. B. Marshall, C.B., has been appointed Director of Dockyards in succession to Sir James Williamson.

Londonderry.—Mr. H. T. Dobbs, late assistant locomotive superintendent of Barry, has been appointed locomotive superintendent of the Londonderry and Lough Swilly Railway.

South Shields.—The Town Council have appointed Mr. John Wilson, general manager of the Corporation Electric Tramways, at £250 per annum. Mr. Wilson has been general manager of the old South Shields horse lines for twenty years, and prior to that he was traffic manager for three years of the steam tramways at Gateshead.

Poole.—Mr. F. W. Lacey, borough engineer of Bournemouth, has been appointed by the Poole Corporation engineer for the construction of a new tramway at Branksome, which is to be worked as part of the Bournemouth system.

Dundee.—Mr. James H. Shepherd has been appointed general manager of Dundee, Broughty Ferry, and District Tramways Company.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—
Consols: Dec. 1st. General Settlements: Nov. 30th; Dec. 14th, 29th. Bank Rate, September 28th, 1905, 4 per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2⅝ — 2¾
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	4¾ — 5¼
8,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3¼ — 3⅜
76,970	5	2/-	Do. 4% Cum. Pref.	5	5¼ — 5½
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	103 —105
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg Mt. Debs. Red.	100	96 — 99
530,000	1	1/7½	Babcock and Wilcox, Ltd., Ord. ..	1	3¾ - 4
100,000	1	7½d.	Do. ,, 6% Cum. Pref.	1	1 7/16 — 1 9/16
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	5 — 5½
250,000	1	6¾d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 1/16 — 1 3/16
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	102 —104
150,000	4½	-/-	Barrow Hæmatite Steel Co., Ld., O	4½	5 — 5¼
60,000	4½	3/-	Do. do. Cum 2nd. Pref.	4½	5 — 5¼
83,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾ — 5¼
£500,000	100	4½%	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	104—106
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	12½ — 13
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	100—102
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	7/16 — 9/16
300,000	1	6¾d.	Do. 5½% Cum Pref.	1	¾ — ⅞
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	93 — 96
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	1 [illegible] — 1 [illegible]
1,860,900	1	3¾d.	Do. Nos. 1,639,101-3,500,000	12/-	[illegible]
1,160,000	1	10½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1⅜ — 1½
590,000	1	1/2	Do. Ord., Nos. 1,160,001-1,750,000	1	1⅞ - 2
74,000	10	5/-	Do. 5% Cum. Pref.	10	11½—12
154,500	5	2/6	Cammell, Laird & Co., Ltd., Ord. ..	5	10¼ - 10¾
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5 7/16 — 5 9/16
450,000	1	1/2½	Clayton & Shuttleworth, Ltd., Ord.	1	15/16 - 1 1/16
70,000	5	2/6	Do. 5% Cum. Pref	5	5⅛ — 5⅜
£250,000	Stk	4%	Do 4% 1st Mort Db. Stk. Red	100	100 -102
100,000	10	30/-	Consett Iron Co., Ltd., Ord.	7½	36½ — 37½
57,031	10	10/-	Crossley, Bros., Ld., Ord 40340/97370	10	15¾ — 16
40,839	10	5%	Do 5% Cum Pref.	10	11½—11¾
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2¼ — 2½
1,259,591	1	3¾d.	Dorman, Long & Co., Ltd.	1	[illegible]
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	92 —96
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating ..	5	4 — 4½
250,000	1	9¾d.	Dunlop (James) & Co., Ltd., Ord. ..	1	13/16 - 15/16
300,000	1	7½d.	Do. 6% Cum. Pref. ..	1	15/16 - 1
4,721	13	14	Ebbw Vale Steel, Iron & Coal Co., Ltd	13	10½ — 11½
69,754	13	10/-	Do. do. do.	10	9 — 9½
20,250	10	8/-	Elliott's Metal, Ltd.	8	5 — 5½
5,000	10	5%	Do. Cum. Pref. 5% .. .	10	8¾ - 9⅛
186,748	Stk	4%	Do. Deb. 4%	100	90 - 94
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. ..	10	11¼ — 12¼
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	100 —103
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord. ..	3	3¾ — 4¼
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5¾ — 6¼
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	7½ — 8
£150,000	Stk	4%	Do 4% 1st Mort Deb Red. .	100	88½ — 89½
16,800	10	11/-	Greenwood & Batley, Ltd., Ord. ..	10	6½ — 7
9,600	10	7%	Do. 7% Cum. Pref.	10	10½ — 11½
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2¾ — 2⅞
344,000	5	2/6	Do. 5% Cum. Pref.	5	6⅛ — 6⅜
£ ,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	106 — 108
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref. ..	5	2¾ — 3¼
260,000	1	1/-	Hadfield's Steel F'dry Co., Ld., Ord.	1	3¾ — 4
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10½ — 11
30,000	5	8/-	Hall (J. & E.), Ltd. 6% Cum. Pref. ..	5	5 — 5½
408,505	1	1/6	Harvey United Steel Co., Ltd. ..	1	[illegible]
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	[illegible]
28,001	5	7/-	Head, Wrightson & Co., Ltd. ..	5	7¾ — [illegible]
85,000	1	7½d.	Hill (Richard) & Co (1899) Ld., Ord.	1	[illegible]
18,000	5	3/-	Do. 6% Cum. Pref.	5	5½ — 5¾
£100,000	Stk	5%	Hornsby (Richard) & Sons, Ld., Ord. 6% Cum Pref.	100	101 — 103

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices.
750,000	1	7½%	Howard & Bullough, Ltd., Ord. ..	1	1 9/16 — 1 11/16
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	12½—13
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	98 —101
37,500	10	20	Kynoch, Ltd.	10	18⅜—18¾
49,537	10	5%	Do. Cum. Pref. 5%	10	11 —11¼
300,000	1	4½d	Lambert Bros., Ltd., Ord.	1	⅝ — ⅞
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4¼—4¾
40,000	3	2/1½	Leeds Forge Co., 7% Cum. Pref. ..	3	4- 4¼
200,000	1	7½d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 5/16—1 7/16
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	108 —110
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11½—11¾
210,000	1	8¾d.	Measures Bros., Ltd., Ord.	1	15/16—1 1/16
75,000	1	6¾d.	Do. 5½% Cum. Pref.	1	15/16— 1 1/16
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	98 — 101
21,943	5	2/6	Muntz Metal, Ltd.	5	4½— 5
14,248	5	5%	Do. Pref. 5%	5	4⅞— 5⅛
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	78 — 81
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12⅜—12⅝
80,000	5	—	North-Eastern Steel Co., Ltd.,		
£250,000	Stk	4½%	4½% 1st Mrt. Db. Stk., Red.	100	89 — 93
122,000	5	1/6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	5 — 5¼
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	6 — 6½
70,000	10	10/-	Pease & Partners, Ltd., Ord. ..	10	13 —13½
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock .	100	99—102
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm. P.	5	4⅞— 5⅛
65,000	1		Pooley (Henry) & Son, Ltd., Ord ..	1	11/ —12/
13,000	5	—	Do. 5½% Cum. Pref.	5	4⅝— 4⅞
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	⅜ — ½
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	2 — 2⅜
73,062	5	2/-	Do. New	5	1⅞ — 2
£330,000	—	5%	Do. 5% Mort. Deb., Red. ..	100	102—104
350,000	1	1/2	Richardsons, Westgarth & Co., Ltd., Ord. 350,001—700,000 ..	1	[illegible]
£350,000	1	7½	Do. 6% Cum. Pref.	1	15/16 —1 1/16
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	98 — 101
35,000	10	12/-	Ruston, Proctor & Co., Ltd... ..	10	10¼ —10¾
275,000	1	6d.	Scott (Walter) Ltd., Ord.	1	[illegible]
800,000	1	7½d.	Do. 6% Cum. Pref. ..	1	1 — 1 1/16
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	94 — 97
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs., Red ..	100	94 — 97
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	97 — 101
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	1 [illegible] — 1 5/16
300,000	1	1/2½	Do. 6% Cum. Pref...	1	15/16 - 1 1/16
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	93 — 96
25,000	10		Stephenson (Robert) & Co., Ltd., Or.	10	2¼ — 2¾
25,000	10	5/6	Do. 5½% Cum. Pref. ..	10	4¾ — 5¼
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	80 — 83
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	19¼ — 19¾
55,000	10	6/-	Do. 6% Cum. Pref	10	14½ — 15
634,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	[illegible]
538,845	1	6d.	Do. 5% Cum. Pref	1	⅞ —1
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	96 — 99
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	[illegible]
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	80 — 84
£118,[illegible]	1	7½d.	Thornycroft (John I.) & Co., Ltd. Or.	1	[illegible] — 1
£160,000	1	7½d.	Do. do. 6% Cum. Pref.	1	15/16 — 1 1/16
10,000	10	5	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9¼ — 9¾
$508,[illegible]	$100	$½	United States Steel Corp. Com. Stk.	$100	38[illegible] - 39¼
$360,[illegible]	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	106¼ - 106¾
$[illegible]	$1000	[illegible]	Do. 10-60 yr. 5% Skg. Fd. G. Bds.	$1000	99⅛ — 100⅛
8,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord. ..	1	2⅝ — 2¾
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	1	1 1/16 — 1 3/16
£[illegible]	Stk	[illegible]	Do. 5% Non-Cum. Pref. Stock.	100	120 —123
£1,[illegible]	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	103 —105
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	105½—107
225,000	1	1/2½	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	1⅛ — 1[illegible]
500,0[illegible]	1	7½d	Do. 6% Cum. Pref. Ord. ..	1	1 — 1[illegible]
£[illegible]	Stk	4%	Do. 4% Perpetual Deb. Stock	100	90 — 93
7[illegible]	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4½ — 4¾
[illegible]	Stk	4½	Do. Mort. Deb. 4½%	100	92 — 98
[illegible]	5	3	Willans & Robinson, Ord.	5	1½ - 2
[illegible]		3/-	Do. 6% Cum. Pref.	5	2½ — [illegible]
£[illegible]	Stk	4	Do. 4% 1st Mort. Deb. Stk. Red	100	85 — 90
£150,000	Stk	4½	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	[illegible] — 7[illegible]

Stocks and Shares marked * [illegible] dend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝ – ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	½ – ⅝
120,000	1	1/3	Bell's Asbestos Co., Ltd.	1	1⅛ – 1½
£40,000	5	14	British Aluminium Co. 7% Cum. Pref.	5	5 — 5½
£300,000	Stk	5%	Do. 5% 1st Mort. Deb. Stk. Rd.	100	98 —102
100,000	5	4	British Insulated & Helsby Cables Ltd., Ord. ..	5	6¾ — 7¼
100,000	5	3/	Do. 6% Cum. Pref.	5	5¾ – 6¼
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	103 —106
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red...	100	98 —100
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 6% Pref. ..	5	2 — 2½
£616,359	Stk	4%	Do. 4% Mort. Deb Stk. Red...	100	85 — 89
105,731	2	2/	Brush Elec. Enging. Co., Ltd., Ord..	2	½ — ¾
150,000	2	2/4½	Do. 6% Pref.	2	1½ — 1¾
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	93 — 97
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	77 — 80
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	11 — 12
40,000	5	2/6	Do. 5% Cum. Pref.	5	5⅝ — 5⅞
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb Stk. Red.	100	109 —111
85,000	3	1/6	Crompton & Co., Ltd...	3	1¾ – 2
£100,000	--	5%	Do. 5% 1st Mort. Reg. Debs.	100	94 — 99
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	8½ — 9
61,000	5	3/-	Do. 6% Cum. Pref.	5	5¾ — 6¼
£300,000	Stk	4½%	Do. 4½% Deb. Stock, Red. .	100	106 —108
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛ — 1¼
£233,334	Stk	4	Do. 1st Mort. 4% free. Deb. Stk.	100	107 – 110
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1½ — 1⅝
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	2 — 2½
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	85 — 90
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	93 — 97
112,100	2	1/7½	Electric Construction Co. Ltd. .	2	1¾ – 2¼
31,890	2	2/9½	Do. 7% Cumulative Pref. ..	2	1⅞ — 2⅛
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	92 — 95
10,248	10	7/6	Evered and Co., Ltd...	10	10 — 12
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½ — 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	96 —100
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	12½ —15½
85,000	5	2/3	Do. 4½% Cum. Pref.	5	5⅛ — 5⅜
£50,000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109 —111
50,000	10	5/	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	16 – 17
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	99 —102
7,500	10		Parker, Thos. Ltd.	10	6½ — 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	17/3 – 17/9
37,350	12	12/	Telegraph Construction and Maintenance Co., Ltd.	12	32 — 34
£150,000	100	4	Do. 4% Deb. Bonds	100	102 104

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
120,000	5	4/	Anglo Argentine Trams Co., Ld., Or.	5	8⅜ — 8⅝
260,007	5	2/6	Do. 5% Cum Pf.	5	5⅝ - 6⅛
£240,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	141 – 144
20,000	10	12/	Barcelona Trams Co., Ltd., Ord. ..	10	13¾ – 14¼
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9¾ – 10
£46,300	100	5	Do. 5% Debs., Red. ..	100	98 - 101
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	97 –102
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	¾ – 1
59,394	1	11/1d.	Do. 5% Cum. Pf. ..	1	⅞ – 1 1/16
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1 — 1½
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	4 – 4¼
£425,000	Stk	4½%	Do 4½% 1st Deb. Stk., Red.	100	95 – 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	124 127*
		5%	Pref. Ord. Stock	100	113 116
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9¾ 10¼
156,437	10	6/-	Do. 6% Cum. Pref.	10	11 – 11½
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	122 124
£250,000	Stk	4½%	Do. 4½% 2nd Deb. Stk. Red..	100	98 –100
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3½ – 3¾
40,500	5	3	Do. "A" 6% Cum Pref. ..	5	5½ – 6
27,000	5		Do. "B" do.	5	5 – 5½
£200,000	Stk	5	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	98 –100
£220,000	100	6	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	101 –103

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares	Last Dividend	Name	Paid up.	Closing Prices.
102,268	5	5/-	Calcutta Tramways Co., Ltd. ..	5	9¼ – 9¾
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	107 109
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	⅞ - 1⅛
40,000	5	2/6	City of Birmingham Trams Co., Ltd. Cum. Pref.	5	4⅞ – 5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	100 – 103
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 – 103
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13¾ — 14¾
59,987	10	6/-	Do. 6% Pref...	10	14½ - 15½
£125,000	Stk	4½	Hastings & Dist. Elec. Trams. Co., Ltd., 4½% Deb. Stock, Red. ..	100	101 103
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2¼ — 2¾
£150,000	Stk	4%	Do. 4% Deb. Stock . .	100	83 — 88
125,000	10	6/-	London United Trams. (1901), Ltd., 6% Cum. Pref. . .	10	10 – 10½
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	100 – 103
60,007	1	-	London Motor Omnibus Co., Ltd., Ord. No. 1-60,007 . .	1	2⅜ – 2⅝
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red.	100	103 - 105
314,016	1	--	Metropolitan Elec. Trams, Ltd., Def.	1	½ — ¾
500,000	1	6d.	Do. 5% Cum Pref. .	1	1 – 1 1/16
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	106 —108
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref	5	½ — 1½
110,923	8	2/9	North Metropolitan Tramways Co. .	8	4½ — 4¾
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	93 — 98
£196,200	Stk	5%	Perth Electric Trams Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	104 —107
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8¾ — 9¼
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9½ — 10
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red	100	101 —104
£160,000	Stk	—	Sunderland Dist. Elec. Trams, Ltd., 5% 1st Mort. Deb. Red ..	100	95 99
£275,000	Stk	12/11	Yorkshire (W. Riding) Elec. Trams Co., Ltd., 4½% 1st Deb. Stk., Red.	100	96 98

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares.	Last Dividend	Name	Paid up	Closing Prices
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd. Ord. ..	10	12½ – 12¾
7,500	10	4/6	Do. 4½% Cum Pref. ..	10	10⅜ — 10⅝
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11¼ – 12¼
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red	100	107 —109
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¾ – 6¼
£50,000	Stk	4½%	Do. do 4½% 1st Deb. Stk. Red.	100	102 —104
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	9¾ — 10¼
12,493	5	3/6	Do. 7% Cum. Pf. Shares..	5	9½ — 9¾
60,000	5	5/-	Calcutta Elec. Sup. Cor. Ltd., Ord. .	5	9 — 9½
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	105 —108
70,000	5	2/6	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord ..	5	6¾ 7¼
80,000	5	2/3	Do. do. 4½% Cum Pref.	5	5½ – 5¾
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	103 –105
41,436	5	2/3	**Chelsea Elec. Sply. Co., Ltd., Ord.**	5	5¾ 6¼
£150,000	Stk	4½%	Do. do 4½% Deb. Stk., Red	100	110 —112
70,595	10	7/-	City of London Elec. Lighting Co. Ld., O	10	11¾ - 12¼
40,000	10	6/-	Do. 6% Cum Pref. . .	10	13¾ 14¼
£400,000	Stk	5%	Do. 5% Deb. Stk., Red .	100	124 –128
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	104 —106
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	9¾ – 10¼
30,000	10	6/-	Do. 6% Cum. Pref. . .	10	12¾ – 13¼
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	111 —114
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord	5	5½ 5¾
70,000	5	3/-	Do. 6% Cum Pref. ..	5	6 – 6¼
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	108 110
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd 5% Deb. Stk. Red	100	85 — 90
19,000	5		Folkestone Elec. Supply Co., Ld., O	5	5¼ — 5¾
£50,000	Stk.	4½%	Do. 4½% Deb. Stk., Red.	100	101 —104
15,000	10		**Havana Electricity Co., Ltd...** ..	10	9 — 10
13,000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	8¼ – 8¾
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100 – 103
150,000	1		Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	15/16 – 1 1/16
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd.. Ord. ..	5	10¾ — 11¼

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	98 —101
111,000	3	1 9¾	London Elec. Supply Corp., Ld., Ord.	3	1¾— 2¼
60,000	5	3/-	Do. 6% Pref.	5	4¾ — 5¼
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red	100	99 -102
100,000	10	5/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	10 —10½
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅛— 5⅝
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	109 —113
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	97 — 99
£250,000	—	4½%	Midland Elec. Corp. for Power Distribution. Ld., 4½% 1st Mort. Deb.	100	101—103½
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½— 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	98 —100
16,500	5	2/6	Oxford Electric Co. Ltd., Ord. ..	5	6¼ — 6¾
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	100 -102
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	100 103
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13 -14
20,000	5	3/6	Do. 7% Pref.	5	8¼— 9¼
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	98 -100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2 — 2½
£50,000	Stk	4%	Do. 4% Debenture Stk Red.	100	76 — 80
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	3½ — 4
100,000	1	—	South Metropolitan Elec. Light & Power Co., Ltd. Ord.	1	13/16 15/16
50,000	1	8¾d.	Do. 7% Cum. Pref.	1	1 1/16 -1 [illegible]
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	105 —108
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4½ — 4¾
30,000	5	2/6	Do. 5% Cum Pref.	5	5 — 5¼
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	104 —106
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12 —12½
28,151	5	2/6	Do. 5% Cum. Pref.	5	6 — 6½

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name.	Paid up	Closing Prices
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	4 — 4½
£763,580	Stk	14/-	Anglo-American Tel. Co., Ltd., Ord.	100	61 — 63
£3,118,210	Stk	28/-	Do. 6% Preferred Ordinary	100	108½ 109½
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	17¾ 18
44,000	5	5/-	Chili Telephone Co., Ltd.	5	7½— 7
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	——
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	96 — 98
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8¾ 9¼
6,000	10	10/-	Do. 10% Preference .. .	10	17 18
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅛ - 3⅝
		5/-	10% Cum. Preference	5	9¼ — 9¾
£30,000	50	4½%	Do. 4½% Debs...	50	100-103
60,710	20	4/-	Direct U.S. Cable Co., Ltd... ..	20	13¼—13¾
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	100—102
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	99 101
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	99 101½
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	14½ 15
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	106 108
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	144 - 147
£2,000,000	Stk	17/6	Do. 3½% Pref.	100	89 91
£1,836,814	Stk	4%	Do. 4% Mort. Deb. .. .	100	106 108
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	35 36
£58,700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	100—102
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	57 —59
72,680	1	9d.	Monte Video Telephone Co., Ltd., O.	1	[illegible]
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	111 113
£1,966,667	Stk	5%	Do. Deferred	100	107 109
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	[illegible]
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	97 — 99
£689,793	Stk	4%	Do. 4% do. do. ..	100	104 106
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1½ — 1¾
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1¼ 1½
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	100—103
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7¾— 8¼
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7 — 7½
40,000	5	2/6	Do. 5% Cum. Pref.	5	5⅞— 6⅜
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	110 112
15,609	10	5/-	W. African Telegraph Co., Ltd. ..	10	10—10½
£30,008	2½	—	West Coast of America, Ltd. ..	2½	[illegible]
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	100 102

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	½— ¾
34,563	10	6/-	Do 6% Cum. 1st. Pref. ..	10	8½— 9
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	6½ 7½
£80,000	100	5%	Do. 5% Deb.	100	101 —104
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	14 —14½
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	102 —104
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	103 —105

VI.—SHIPPING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	9¼— 9¾
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	99 —101
£672,900	Stk	4½%	British & African Stm. Nav. (1900), Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	98 —100
10,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	5¾— 6¼
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	91 — 94
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	99 —101
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	14¼ 14¾
40,000	20	8/-	Do. Nos. 60,001-100,000	10	6¼ - 6¾
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	102—104
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1½ — 1⅝
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	5 — 5½
36,758	8	4/9½	Do. Non-Cum. 6% Pref.	8	8½— 9
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	98 —100
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2 — 2½
40,000	5	2/9	Do. 5½% Cum. Pref.	5	2¾— 3¼
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	88 — 91
141,500	10	5/-	Leyland (Fredk.), & Co., (1900), Ltd., 5% Cum. Pref. ..	10	6 — 6½
20,349	10	5/-	Orient Stm. Nav. Co. Ltd., Pref. Nos. 1-20,349 ..	10	7 7½
£103,100	Stk	4%	Do. 4% Deb. Stk., Red. .	100	89—92
£1,160,000	Stk	5%	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	127—130
£1,160,000	Stk	19%	Do. do Deferred ..	100	245 - 248
15,000	100	30/-	Royal Mail Steam Packet Co. Ord .	60	45 — 47
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5¼
39,075	5	2/6	Do "B" Ord...	5	3¾ — 4¼
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8¾— 9¼
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	10¼ — 10¾
£1,008,[illegible]	Stk	4%	Do. 4% Debenture Stk., Red.	100	100 —103

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed	Shares.	Last Dividend	Name	Paid up.	Closing Prices.
60,000	1	9⅜d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1 1/16—1 5/16
£750,000	Stk	5%	General Hydraulic Power Co., Ltd.	100	124 —129
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	26 — 28
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	¼ — ⅜
66,462	1	8·4d	Do. do. Nos. 1-66,462	1	⅜— ½
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1⅛ —1¼
135,000	1	7½d.	Do. 6% Cum. Pref. ..	1	1⅛ —1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

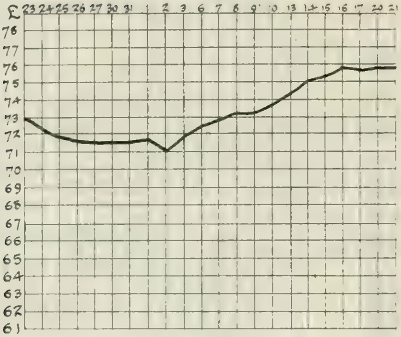
Present Amount Subscribed	Shares	Last Dividend.	Name.	Paid up.	Closing Prices
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	25 — 26
8,739	10	3/-	Do. Second Issue 1-8,739....	4	9¼ 9¾
10,000	10	6/-	Do. Cum. Pref 6%, 1-10,000..	10	13¾ -14½
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,900	7	10¼— 10¾
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4½ — 4¾
41,567	10	1/8	Lancashire Wagon, Ord.	2	2¼— 2¾
4,150	10	5%	Do. do.	10	10⅛ — 10⅝
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	2 1/16 2 5/16
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	1⅛— 1¼
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	28/6 -29/6
20,000	20	20/-	Midland Rail. Car & Wagon, Ld., 1-20,000	10	20 — 21

Stocks and Shares marked * are [illegible] dividend.

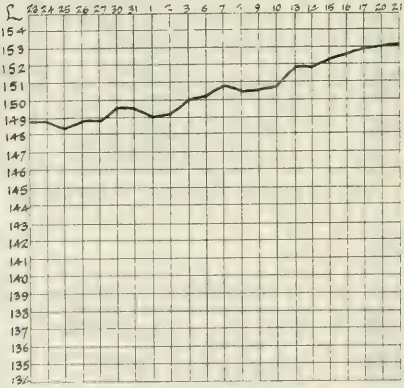
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM OCTOBER 23RD TO NOVEMBER 21ST, 1905.

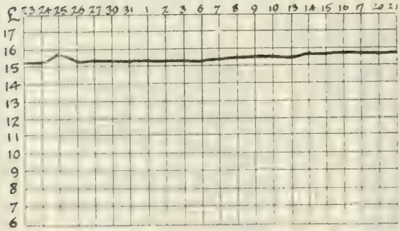
COPPER.



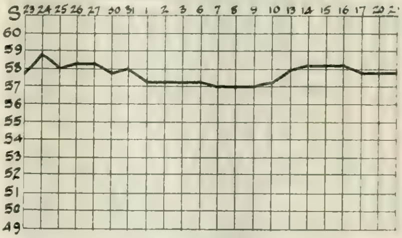
TIN.



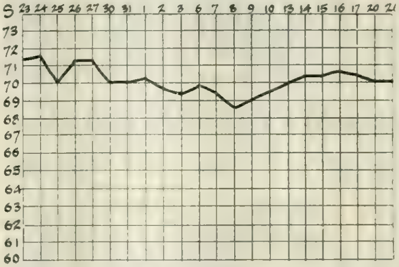
ENGLISH LEAD.



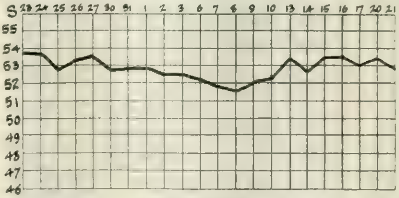
PIG IRON: SCOTCH.



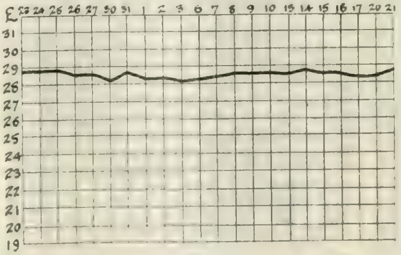
HEMATITE.



CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, November 22nd, 1905.

THE middle of November statistics brought out very clearly the strong position of Copper. During the past months the stocks of Chili Bars in Liverpool and Swansea have decreased about 1,700 tons, which quantity has gone into actual consumption during that period. The market has naturally been strong on these figures, and some good speculating buying orders have assisted the rise in quotations, as high as £76 having been paid for cash copper at the end of last week. There was some relapse from this figure, but at the time of writing the market is firm at £75 15s. cash, and £73 5s. three months.

The Tin market remains fairly active, and shows renewed firmness on strong Eastern and American advices. There has been a good deal of realisation of speculative holdings on the part of people with a natural desire to snatch profits, but all offerings have been well absorbed, and higher prices are looked for in the immediate future. The closing quotations yesterday were £153 cash, and £152 three months.

The Lead market varies from steady to firm, and although the buying on behalf of consumers has been small, some speculation for forward delivery has served to hold up quotations to about last week's level, £15 10s. being the latest quotation for soft foreign prompt. Spelter is practically the only metal which has not joined in the upward movement, the explanation being that many consumers have now covered their immediate requirements, and are indisposed to make further commitments at ruling quotations.

In the iron and steel section considerable fluctuations are to be noticed. Bear selling and realisation on the part of speculative holders brought about a fall, but at the lower quotations strong support was forthcoming and a recovery ensued. The reports from trade centres are encouraging, and the position in the United States is stated to be exceedingly sound. Stocks of Middlesbrough iron show a small increase which may encourage the bears, but the Continent is inclined to buy Cleveland, and this may have a favourable effect upon the statistical position in the near future. The current quotations are Cleveland, 53s. 3d.; Scotch, 57s. 9d.; and Hematite, 7[illegible]s.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

Steel :

		£	s.	d
DALZELL	Siemens' Steel Plates, Marine Boiler Quality ..	8	2	6
	,, ,, ,, Land ,, ,, ...	8	2	6
STEEL	,, Steel Bars, Boiler Quality	8	5	0
DALZELL	Siemens' Steel Plates, Ship Quality Plates... .	7	2	6
	,, ,, Bars ,, ,, ...	7	15	0
STEEL	,, ,, Angles	6	15	0

Manufactured Iron :

	£	s.	d
Bars – Dalzell	7	2	6
,, Best	7	12	6
,, ,, Horseshoe	7	12	6
,, Angle	7	2	6
,, Best Angle	7	12	6
,, Best Best	8	2	6
,, Extra Best	8	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

Malleable Common Bars :	£	s.	d	
Dalzell, per ton	7	2	6	5 per cent.
Govan	6	10	0	,,
North British	6	10	0	,,
Drumpellier	6	7	6	,,
Waverley	6	10	0	,,
[illegible]	6	5	0	,,
Dundyvan	6	5	0	,,
Monkland	6	5	0	,,
Rochsoloch	6	5	0	,,
Phoenix	7	5	0	,,
Coatbridge	7	2	6	,,
Coats	6	5	0	,,
[illegible]				,,
Steel Plates, Ship				,,
Boiler Plates				,,
[illegible]				,,
[illegible]				,,

[illegible], No. 1 [illegible] No. 3, 61s.

John Spencer (Coatbridge), Ltd., Phœnix Iron-works, Coatbridge, N.B., quote :—

	£	s.	d.
Bars – Phoenix	7	5	0
Best	7	15	0
Best Best	8	5	0
Extra Best	8	15	0
Best Horse Shoe	7	15	0
Extra B H S	8	15	0
Extra Best Cable	9	5	0
Rivet	7	[illegible]	
Best Scrap Rivet	8	[illegible]	

	£	s.	d.
Angles—Phœnix	7	5	0
,, Best	7	15	0
,, Extra Best	8	5	0
Gas Tube Hoops—Phœnix Best	7	15	0
Plates—Phœnix	—		
,, Best Boiler	8	10	0
,, Best Best Boiler	9	0	0
,, Extra Best Boiler	10	0	0
Boiler Tube Strips—Phœnix	9	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote (Commission extra).

Pig Iron:	No. 1. £	s.	d.	No. 3. £	s.	d.
Coltness, f.a.s. Glasgow	3	16	0	3	6	0
Gartsherrie ,,	3	8	6	3	3	6
Summerlee ,,	3	11	0	3	6	0
Carnbroe ,,	3	5	0	3	2	0
Langloan ,,	3	10	0	3	5	0
Calder ,,	3	7	6	3	2	6
Clyde ,,	3	8	0	3	3	0
Glengarnock, f.o.b. Ardrossan	3	8	0	3	3	0
Eglinton ,, ,,	3	2	6	3	0	0
Dalmellington, ,, Ayr	–			3	0	0
Shotts ,, Leith	3	7	6	3	2	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W ♛ Bars	7	5	0
W.W. Best Bars	7	12	6
W.W. Best Best	8	0	0
W.W. Best Best Best	8	7	6
W.W. Best Shoe	7	15	0
Thornaby ♛	8	15	0
Thornaby Best	9	5	0
Thornaby Best Best	10	5	0
Whitwell Special Admiralty Cable	10	15	0
Special Chain Iron	9	15	0
[illegible] Nail Strip Iron net cash	7	5	0
W.W ♛ Angle Iron	7	7	6
W.W. Best Angle Iron	7	15	0
Tee Iron to 8 inches United	8	5	0

Terms, Cash less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington. [illegible] that in the present uncertain state of the market their quotations are temporarily withdrawn.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G 96in. by 36in. per ton. £	s.	d.	Doubles 21 G to 24 G 96in. by 36in per ton £	s.	d.
Black Sheets						
"Vale"	10	10	0	11	0	0
"Shield"	11	0	0	12	0	0
"Severn"	12	0	0	13	0	0
"Baldwin Wilden B"	13	0	0	14	0	0
Charcoal	17	0	0	18	0	0
Best Charcoal	19	0	0	20	0	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:	£	s.	d.	£	s.	d
No. 3 Lead	14	0	0	15	0	0
S.V. Lead	15	10	0	16	10	0
No 3 Terne	15	10	0	16	10	0
S.V. Terne	17	0	0	18	0	0

Tinned Sheets:	Singles 20 G to 108 by 36in. per ton. £	s.	d.	Doubles 21 to 24 G to 96 by 36in per ton £	s.	d
Best Coke (Finish)	29	0	0	30	10	0
,, Charcoal (Finish)	31	0	0	32	10	0
Extra ,,	33	0	0	34	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	13	5	0	per ton.
"Blackwall" Brand, 26 G., in felt lined cases for Australia, f.o.b. London	15	10	0	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	14	5	0	per ton

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	7	5	0	per ton
Best Bars (1 to 6 in. wide, above ¼ in. thick, ½ in to 4 round and squares)	7	15	0	,,
Angles	7	10	0	,,
,, Best	8	0	0	,,
T's	7	15	0	,,
,, Best	8	5	0	,,
Best Shoe Iron	8	15	0	,,
,, Rivet Iron	8	15	0	,,
,, Best Rivet (Special)	10	0	0	,,
,, Cable	10	0	0	,,
,, Screwing	9	0	0	,,

	£	s.	d	
Best Turning	8	15	0	per ton.
,, Plating	9	0	0	,,
Best Best	10	0	0	,,
Treble Best	11	0	0	,,
Plates	8	5	0	,,
Best Plates	8	15	0	,,
,, Boiler Plates	9	5	0	,,
,, Best Boiler Plates	10	5	0	,,
Treble Best Boiler Plates	12	15	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails steel nails, &c.

Discounts—

42½ per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

37½ per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

37½ per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis :—

2 tons 10/6 per cwt.
4 cwt. lots and upwards 10/9 per cwt.
d/d any Railway Station

Steel cut nails, 3-inch to 6-inch basis—

2 tons 9/3 per cwt.
4 cwt. lots 9/6 per cwt.
d/d any Railway Station.

Slit rods (iron) £8 per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E.C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote :—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	13	3
C 20 by 10 225s. 155 ,, "Jumbo"	0	18	9
C 20 by 14 112s. 108 ,, "Lydbrook"	0	13	0
C 28 by 20 112s. 216 ,, "Lydbrook"	1	6	3
Charcoal Tinplates :			
C 20 by 14 112s. 108 lb. "Allaway"	0	13	9

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes :—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

		£	s.	d	
Steel:					
Blooms	at	4	2	0	per ton.
Billets	at	4	4	0	,,
Sheet Bars	at	4	6	0	,,
Finished Steel:					
Bars	at	5	15	0	per ton.
Angles	at	5	16	0	,,
Tees	at	5	19	0	,,
Joist	at	5	0	0	,,
Fencing Standards	at	5	15	0	,,
Shoeing Bars	at	5	19	0	,,
Tyre Bars	at	5	19	0	,,
Half-Round Bars	at	6	3	0	,,
Heavy Rails	at	5	10	0	,,
Light Rails	at	5	10	0	,,

Structural Steelwork :

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote :—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1½%, & 1%	155	10	0	to	156	0	0	per ton
English Bars, f.o.b. Dis. 1½%, & 1%	156	10	0	to	157	0	0	,,
Straits G.M.B., cash Warehouse, Net	153	0	0	to	152	2	6	,,
Straits G.M.B., 3 months, Warehouse, Net	152	5	0	to	152	7	6	,,
Australian, Mt. Bischoff, Warehouse, Net	153	10	0	to	153	15	0	,,

COPPER.

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	75	15	0	to	76	0	0	per ton
Standard G.M.B., 3 months, Warehouse, Net	74	2	6	to	74	5	0	,,
English, Tough, Cake & Ingot, Warehouses, Net	78	10	0	to	79	0	0	,,
English, Best Select, Warehouse Net	79	10	0	to	80	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	87	0	0	to	88	0	0	,,
English, Sheets for India, f.o.b., Dis. 2½	82	0	0	to	82	10	0	,,
Electro, Warehouse, Net	79	5	0	to	79	10	0	,,
Ore, ex ship	0	13	3	to	0	14	3	per unit
Regulus, Matte and Precipitate, ex ship,	0	14	3	to	0	14	9	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½	0	0	7	per lb
Sheathing ,, ,,	0	0	7¼	,,

SPELTER.

	£	s.	d.		£	s.	d	
Silesian outports, Net	28	0	0	to	28	5	0	per ton
Blende of 50 %, Net	8	0	0	to	8	7	6	,,
Calamine, Net	8	9	0	to	8	10	0	,,

LEAD.

	£	s.	d.		£	s.	d	
English Pig, Warehouse, Dis 2½	15	15	0	to	15	17	6	per ton
Spanish, ex ship, Dis. 2½	15	7	6	to	15	10	0	,,
Lead Ore of 70 %, Net	7	10	0	to	8	0	0	,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½	52	0	0	to	53	0	0	per ton
Ore 50 %, ex ship, Dis. 2½ %	12	10	0	to	15	0	0	,,
Crude ex ship, Dis. 2½ %	25	0	0	to	30	0	0	,,

QUICKSILVER.

	£	s.	d	
Spanish, 75 lb. Warehouse, Net	7	5	0	per flask
Italian	7	2	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.	s.	d.
Main Coal	6	6
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	0
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	3
Large Nuts (1½ to 3½)	9	0
Small Nuts (⅝ to 1½)	6	0
Peas (⅜ to ⅝)	5	0
Rough Slack	4	0
Slack	3	6
Smudge	2	0

Rutland Coal:	s.	d.
Brights (4 to 8)	7	6
Large Nuts (2 to 4)	7	0
Slack	3	6
Hand-picked Hards	7	6
Hard Cobbles	6	3

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

STEAM.	s.	d.
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.

HIGH HAZEL (or Ashless House Coal).	s.	d.
London Brights, 4 to 8 in. cube	11	0
Best Cobbles (Hand Picked)	10	6
Large Nuts, 2 to 4 in. cube	10	0
Small Nuts, 1 to 2 in. cube	6	3
Pea Nuts, ⅝ to 1 in. cube	5	0

STEAM [illegible] HARD	s.	d.
Best Hard	8	6
Hard Steam	7	6
Cobbles	6	3

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: Oxalic	0	0	2½	per lb
Picric, Crystals	0	0	11	,,
Tartaric .. at Manchester	0	0	10¾	,,

	£	s.	d.	
Acetate of Lime: Brown at Manchester net	8	10	0	per ton.
Grey ,,	11	15	0	,,
Alumina: Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,
Ammonia: Carbonate	0	0	3⅝	per lb.
Muriate Grey f.o.b. Liverpool	24	15	0	per ton
Sal-ammoniac, Lump, 1sts, delᵈ. U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate f.o.b. Liverpool	12	15	0	,,
Arsenic: Best White Powdered net	15	0	0	,,
Bleaching Powder, 35% ,,	4	7	6	,,
Borax: British Refined Crystal ,,	13	0	0	,,

Coal Tar Products:				
Benzole, 50/90 % ,,	0	0	9	per gal
,, 90% ,,	0	0	10	,,
Carbolic Acid Crystals, 34/35° C. ,,	0	0	5¼	per lb
,, ,, ,, 39/40° C. ,,	0	0	6	,,
,, ,, Liquid, 97/99 % ,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	1	9½	,,
Creosote, ordinary good liquid ,,	0	0	1¾	,,
Naphtha, Crude, 20% at 120° C. ,,	0	0	4¼	,,
,, Solvent, 90%, at 160° C.f.o.b ,,	0	1	0	,,
,, ,, 95 % at 160° C. ,, ,,	0	1	0½	,,
,, ,, 90 % at 190° C. ,, ,,	0	1	1½	,,
,, Rectified, flash point over 73° F. f.o.b. ,,	0	1	1½	,,
,, Rectified, flash point over 100° F. f.o.b. ,,	0	1	2	,,
Naphthalene, all qualities.				
Pitch f.a.s. Manchester. ,,	1	14	0	per ton.
Copperas: Green, in bulk ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	1	18	6	,,
Cake ,,	1	1	6	,,
Copper: Sulphate	22	15	0	,,
Cyanides: 98% minimum .. f.o.b net	0	0	7½	per lb.
Lead: Acetate (Sugar) White, English	27	10	0	per ton.
,, ,, Foreign c.i.f U.K	24	0	0	,,
,, Grey	22	15	0	,,
,, Brown at Manchester	17	5	0	,,
Nitrate	25	10	0	,,
Litharge, Cake	17	0	0	,,
,, Powder	17	10	0	,,
Red Lead, Genuine, c.i.f London less 5%	16	10	0	,,
White ,, Dry .. .. ,,	17	10	0	,,
Naphtha (Wood) Miscible, 60 o.p.	0	2	4	per gal.
Solvent	0	2	7	,,
Potash: Bichromate delivered England	0	0	3	per lb
Carbonate, 90/92 % c.i.f Hull	17	15	0	per ton.
Caustic [illegible]	19	5	0	,,
Chlorate net	0	0	3¼	per lb.
Muriate [illegible] in Store, Liverpool	31	10	0	per ton.
Prussiate, yellow net	0	0	4½	per lb.

	£	s.	d.	
Soda: Ash, Caustic, 48 %, Ordinary .. net	5	5	0	per ton.
,, ,, ,, Refined...... ,,	6	5	0	,,
,, Carbonated, 48 %........... ,,	5	10	0	,,
,, ,, 58 % (Ammonia Alkali) ....net	4	10	0	,,
,, Bleachers' Refined Caustic 50/52 % .... net	6	10	0	,,
Caustic, White, 77 % .... ,,	10	12	6	,,
,, ,, 70 %.............. ,,	9	12	6	,,
,, ,, 60 %.. .... ,,	8	12	6	,,
,, Cream, 60 %..... .. .. ,	8	10	0	,,
Crystals, in bags	3	0	0	,,
,, barrels	3	7	6	,,
Acetate .... c.i.f. Hull net	16	10	0	,,
Bicarbonate, in 1 cwt. kegs...........	6	15	0	,,
Bichromate......delivered England...	0	0	2¼	per lb.
Chlorate .... net	0	0	3¼	per lb.
Nitrate...ex quay Liverpool, ...	11	0	0	per ton.
Phosphate	9	5	0	,,
Prussiate ....net	0	0	$3\frac{7}{16}$	per lb.
Silicate, Solution, 140° Tw.	4	10	0	per ton.
Sulphate (Glauber Salts)...............	1	10	0	,,
,, (Saltcake, 95%)...............	1	15	0	,,
Sulphur: Recovered	4	15	0	,,
Roll	6	15	0	,,
Flowers..................................	7	10	0	,,
Zinc: Sulphate	6	15	0	,,
Shellac: Standard TN orange spot	9	0	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote:—

	£	s.	d.	
Barytes: Lump Carbonate, 90/92%	3	10	0	per ton.
Sulphate, No. 1, White	2	15	0	,,
China Clay: of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore: Basis 50% c.i.f. British Ports..	3	10	0	,,
Manganese: Lump c.i.f. Liverpool 10¼d.	per metallic unit.			
Ochre: French JC .... f.o.b. Rouen, net	2	5	0	per ton.
,, JF	5	10	0	,,
Talc: (French Chalk).........c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote:—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	13	3	to	0	14	3	per unit.
Regulus, 45 to 55%, ...	0	14	3	to	0	14	9	,,
Precipitate, 65 to 80% ...	0	14	4½	to	0	14	10½	,,
Tin Ores, 70 %..............	95	0	0	to	97	0	0	per ton
Lead Ore, 70%					8	0	0	,,
Blende, 50%					8	6	6	,,
Calamine..........					8	9	0	,,
Antimony, Star Regulus	48	0	0	to	50	0	0	,,
,, Ore 50%	12	10	0	to	15	0	0	,,

Messrs. Barrington and Holt, Cartagena, quote:

Iron Ore

			s.	d.	
Ord. 50%, ...	f.o.b.	Porman	7	6	per ton.
Do.	,,	Cartagena	7	10	,,
Special low phos.	,,	Porman			
Do. do.	,,	Cartagena.............	8	2	,,
Extra quality do.	,,	,, ...	8	6	,,
Special Iron Ore	,,	,, ...	nominal		,,
Specular 58% do.	,,	....	11	0	,,
S P Campanil Coast	,,	. ..	9	6	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine.........	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	3
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine ..	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do	,,	11	10	0		13	0	0
St. John, Miramichi, etc., Spruce	,,	7	10	0		7	15	0
Nova Scotia Spruce	,,	7	7	6		7	12	6
Spruce Boards.................	,,	6	7	6		6	12	6

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks . .	,,	0	1	6		0	2	1
East India Teak	per load	12	0	0		19	0	0
Greenheart...	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d
Riga Redwood	per cub ft	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling ...	,,	0	1	9		0	1	11
Stettin . . .	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood . .	,,	0	1	0		0	1	3
Norway Mining Timber .	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak	,,	0	2	6		0	3	0
Norway Spars . ..	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality ..	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality . ..	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality ...	,,	10	10	0		12	10	0
St. Petersburg, 1st quality	,,	16	0	0		17	10	0
Do. 2nd	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyborg . ..	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this Journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When patents have been communicated the names of the communicators are printed in *italics.*

22701. J. W. Cross, London. Nov. 6th.—Improvements in or relating to internal combustion engines.

22704. E. Capitaine, London. Nov. 6th.—Improvements in and relating to explosion engines.

22712. W. T. Carter, Birmingham. Nov. 6th.—Improvements in rotary motors or engines.

22729. A. J. Boult, London. Nov. 6th.—Improvements in or relating to carburetters for explosion engines. (*Henri Labre, France.*)

22770. F. C. Lynde, Manchester. Nov. 7th.—Improvements in carburetters and the like.

22821. W. Loh, London. Nov. 7th.—Improvements relating to turbines. (Date applied for Nov. 7th, 1904.)

22834. T. H. C. Homersham and Thwaites Bros., Ltd., London. Nov. 7th.—Improvements in pumps.

22835. T. H. C. Homersham and Thwaites Bros., Ltd., London. Nov. 7th.—Improvements in pumps.

22839. W. F. C. Ward, Surrey. Nov. 7th. Improvements in and connected with lubricators.

22858. C. E. Lyon, Manchester. Nov. 8th.—Improvements in internal combustion engines.

22873. W. J. Poole, Glasgow. Nov. 8th. Improvements in and connected with turbine blades.

22947. W. Maybach, London. Nov. 8th.—Improvements in or relating to the transmission of power from internal combustion engines.

22951. H. L. Manning, London. Nov. 8th. Improvements in and relating to marine propulsion.

22954. G. C. Reeds, London. Nov. 8th.—Improvements in contact breakers for electric ignition gear of internal combustion engines and the like.

22974. T. W. S. Hutchins and J. B. Wilkie, Manchester. Nov. 9th.—Improvements in producer gas generators.

23024. J. S. Rasmussen, London. Nov. 9th.—A new or improved apparatus for separating oil from exhaust steam.

23041. C. List and H. Bock, London. Nov. 9th.—Improvements in or relating to reversing gear for steam turbines.

23064. H. Connell, Glasgow. Nov. 10th. Improved valve gear for steam pumps.

23065. P. Mahoney and A. M. Hunt, Bristol. Nov. 10th.—Improved rotary motor engine.

23066. W. R. Ridings, Nov. 10th.—Improvements in or relating to internal combustion engines.

23084. F. W. Mellowes, London. Nov. 10th.—Improvements in or relating to glazing devices.

23110. E. Rotter, London. Nov. 10th.—Improvements in connection with steam superheaters.

RECENT SPECIFICATIONS.

IMPROVEMENTS IN OR RELATING TO A FLUID PRESSURE MOTOR AND GENERATOR SYSTEM.

J. E. Gibbs, York, and F. H. Sheppee, Bracknell, October 19th, 19[illegible]. This invention relates to improvements in the construction of the operative parts of a fluid pressure motor and generator system, and in the working of same so as to avoid damage to the generator sections by overheating, it being especially applicable to steam generators fired with liquid fuel.

The principle made use of is that by keeping the temperature of the generator at a constant predetermined amount, no matter whether the motor is stationary or subject to heavy load, it will be free from the liability to overheating, which does so much damage to similar generators at the present time, and will also very materially lessen the severe strains and wear and tear to which frequent and large variations of temperature now subject them, while the necessary variation in the amount of steam required is obtained by regulating the amount of water supplied to said generator; the principle is applicable mainly to flash boilers, and in their case the pressure of the steam will be independent of the temperature of the boiler sections; the pressure will be regulated according to the amount of feed water supplied, and the feed water will be regulated by the driver of the vehicle according to the speed required or the load carried.

Attempts have hitherto been made to satisfactorily effect this result, but up to the present so far as is known without producing an apparatus which will work satisfactorily, economically and without getting out of order for a considerable length of time.

Such a generator as is referred to has hitherto been fired in the lighter types of motor vehicles by employing petroleum oil of some kind supplied under pressure to burners beneath the generator, and a common practice hitherto has been to pump both the water and the oil required by a pump operated by a common system of levers [illegible] or the like, the oil and water being directly proportional to each other therefore, and not capable of immediate variation disproportionately; frequently also the water has been pumped against the pressure due to a relief valve on the boiler, which is wasteful both of water and of power. The water and oil pumped being directly proportioned and manually regulated by the driver according to the steam pressure [illegible], it is almost impossible to control them with success and to obtain constant results over a wide range of powers.

The difficulty has been to construct a means of keeping the temperature of the generator constant between such widely varying limits as no load and full load on the motor, at the same time that [illegible] variations in the supply of steam are maintained by the generator, and the steam kept dry.

The subject of this invention consists in constructing a continuously-running water pump, a continuously-running air pump giving the oil supply to the burners by means of a constant air pressure maintained on the oil supply tank and regulating the quantity of oil supplied to the burners according to the temperature of the furnace by means of a thermostatic appliance therein operating an oil supply valve.

The water supply obtained by a pump driven continuously, either directly by the engine shaft or through the medium of a counter shaft, is controlled by a hand lever connected to the suction valve of the pump, so as to vary the amount retained in the pump for delivery, this being preferably the device for which a patent was applied for under the number 1424[illegible] of the present year.

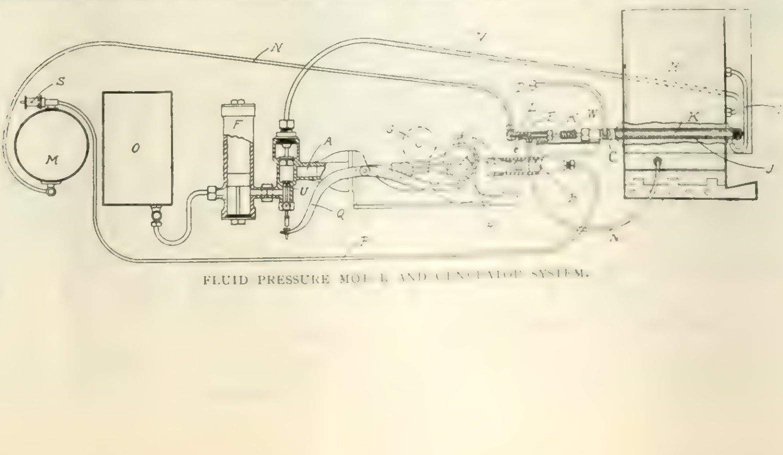
The air pump for giving pressure on the fuel oil tank is also driven by the pump shafting which maintains a constant pressure on the fuel oil to the controlling valve, the supply from thence to the furnace or burners being controlled automatically by the thermostat.

The thermostat consists of a metal tube with a rod of a different co-efficient of expansion inside, and suitable connections for the inlet and outlet of the steam supply from generator to engine are made in the tube, also the tube is provided with a gland at the end through which the inner rod protrudes, and the said inner rod is fixed to the other end of the tube and made steam tight. The protruding end is attached to a valve with a taper plug on the supply pipe of the liquid fuel to the burner of the furnace, so that if the temperature of the steam becomes too high the inner rod causes the tapered plug to stop the flow of fuel to the burner of the furnace. This is of the greatest value in the case of a driver stopping the car and omitting to shut off the oil fuel supply to the furnace, as damage to the generator frequently results therefrom; moreover, it is often very inconvenient to shut off the supply completely, as the furnace would go out; to avoid this such a tapered plug may be provided with a groove cut on its surface, which allows of a small amount of oil passing the valve to maintain the requisite temperature of the generator and keep the burner or furnace in an efficient state.

The accompanying drawing illustrates diagrammatically the method by which the various parts mentioned are combined as a whole to form a fluid-pressure motor and generator system, and shows the shaft of the motor to the cylinder of which (not shown) steam is supplied by a pipe connected with the boiler by means of the pipe seen on the boiler and the [illegible] thermostat. The rod of the thermostat [illegible] to the casing at its inner end is provided at its opposite end with a coned plug which fits in the coned surface, forming the valve casing; a spring [illegible] is inserted in the rod to obviate any bending thereof under excessive expansion; the generator is fired with oil such as paraffin a supply of which is contained in the tank seen on the left of the drawing under the constant pressure of air which forces it along a pipe and past a valve to the furnace of the generator where it is burned. The thermostat is placed just above the furnace and is so constructed that when the furnace temperature rises too high the rod expands and closes the valve and the oil supply to the burners is thus reduced; the boiler is thus prevented from getting too hot and burning out the tubes. In order that the burners shall always remain alight, even if the valve closes altogether, a groove is cut on the coned plug through which a small amount of oil will always find its way, at least sufficient to prevent the flame of the burners from going out.

The temperature of the furnace being kept constant or nearly so, the variations in the power required are obtained by forcing more or less water into the generator, which thus produces a corresponding greater or less quantity of steam; this variation in the water supply is obtained by the use of a pump, for which a patent was granted under the number 14240 of 1905, the special feature of same being that a suction valve is operated mechanically, so as to only allow of the required amount of water being delivered. The variation in the amount of water is obtained by varying the position of a cam by means of a hand lever (not shown on the drawing), the motion of said cam being transmitted through a lever to the suction valve. A tank is also supplied for holding the supply of water and also an air vessel for equalising the pressure of the water. When a small amount of water is required, the suction valve is kept open for a long time, whereas if a large quantity of water is required the suction valve is closed as soon as possible, so that all the water drawn into the pump is delivered. The delivery of water to the generator is made through the pipe seen. To the shaft driving the pump an auxiliary crank is attached, which drives the air pump for forcing oil into the oil tank. A relief valve allows of any excess of air escaping when the required pressure is reached.

A considerable advantage is gained by the construction set out herein, in that only precisely the amount of water needed for the given amount and pressure of steam required is pumped. A saving of the oil fuel is also attained by the automatic control valve, regulated according to the temperature of the generator, in addition to the greater safety of the generator and [illegible] longer life of its parts.



FLUID PRESSURE MOTOR AND GENERATOR SYSTEM.

NEW PUBLICATIONS.

"NEW METHODS OF TESTING EXPLOSIVES."

By C. E. Bichel. Translated and edited by Axel Larsen, M.Inst.M.E. 6s. net. Charles Griffin and Co., Ltd.

Among the many scientists who have made a special study of the essential properties of explosives and the phenomena of their decomposition few have added more to our technical knowledge of these substances than Mr. C. E. Bichel, the value of whose recent achievements in practical research, and his initiative in devising new methods and apparatus for elucidating the causes of ignition of fire-damp by explosives, would be difficult to estimate. The present account of his investigations deals with the following questions which were the basis of practical research at the Carbonite Works, Schlebusch: Why does a smaller quantity of one explosive than another cause ignition of fire-damp? What are the incidental phenomena and the influences tending to promote such results? and in what manner do they co-operate in producing it? Special apparatus was designed and a series of experiments extending over eight years were carried out in order to obtain a solution of these problems. At the outset it was decided to forego the more purely theoretical treatment of the subject and to follow almost exclusively the experimental method. In the chapter on testing-stations it is pointed out that although none of the German stations give identical results, trials are fairly uniform, and the differences between the various explosives when compared with one another are generally concordant. Some suggestions are made as to how to establish uniformity both in the system and in the mode of conducting experiments. The second chapter describes and illustrates the Tranzl lead-block test, Bichel's pressure-gauge, etc. The products of combustion, dealt with in the next chapter, is followed by a discussion of the heat of decomposition, the rate of detonation, length and duration of flame, after-flame ratio, and transmission of explosion. The writer then summarises his conclusions and tabulates the results of his investigations so as to place the various explosives in a series according to their safety.

BOOKS RECEIVED.

"The Royal Naval List and Naval Recorder," October, 1905. (Witherby and Co. 10s.) A book of reference relating to the personnel of the navy, both active and retired, and the ships of the fleet. In addition to the customary features which have won a recognised place for this excellent work of reference, an interesting bibliography of naval literature is included.—"The Proceedings of the Chemical, Metallurgical and Mining Society of South Africa," May, 1902, to June, 1903. Vol. III. (Published by the Society, Johannesburg, and R. W. Hunter, Edinburgh.) Judging by this recently issued volume of proceedings the Society must be in a very prosperous condition; the papers read before the monthly meetings are essentially practical and reach a high order of excellence.—"The Use and Care of Chains for Lifting and Hauling" ([illegible] Queen Victoria Street. 1s. net). A paper read before the Civil and Mechanical Engineers' Society. By Henry Adams, M.Inst.C.E. We are glad to note that it has been found necessary to print a second edition of this valuable paper, which is probably the only tangible matter on the subject.—"Work." The illustrated weekly journal of handicrafts, vol. xxix. (Cassell and Co. 4s. 6d.) The latest volume of this popular periodical well maintains the standard of usefulness set up by its predecessors.

NEW CATALOGUES.

Birkett and Robinson, Albion Works, Cleckheaton.—A well-produced advance booklet on somewhat original lines calls attention to a wide range of engine and boiler fittings. The firm's Paragon patent sight feed lubricator has a large glass tube to prevent blearing, and is secured with small gland and indiarubber rings to prevent torsion when tightening up the tube. Another advantage is the patent cone and ball condenser. The cover of this list is tied with a silk cord, and an oval cutting throws into relief an illustration of the firm's asbestos packed gland cock.

W. T. Glover and Co., Ltd., Trafford Park, Manchester.—An exceedingly neat folding card, with gilt-lettered cloth cover, has been designed to illustrate the firm's joint boxes and fittings. It presents representative specimens, descriptions, and prices in handy form, and gives concise instructions for jointing Glover's cables in the aforesaid boxes. The question of bonding now enters very largely into joint box work, and there are a number of methods in use, but most of the various consulting engineers have their own favourite arrangements, as have many engineers responsible for the electric supply of townships. The firm mention that their own practice has been to make an ample lashing of strand (at least 7/16 S.W.G.) of tinned copper wire on each side of the joint, and to sweat this solidly on to the lead. With extra high tension cables, which are usually galvanised iron wire armoured, a ferrule has been slipped over the armour and a strand of tinned copper cable carried across the box after binding and sweating it on to the ferrule at each end. Both these methods are found to be simple and satisfactory under most circumstances. The firm has also issued a valuable booklet containing electrical mining data.

David Bridge and Co., Castleton.—In another section of this journal we recently illustrated the latest catalogue cover employed by the above firm in connection with their friction clutches, gearing, shafting, and hauling installations. We need only add that the interior of the catalogue is just as business-like, being well-arranged, indexed and illustrated. There is a sufficiency of instructions, hints, prices, dimensions, and useful information in this catalogue to render it a valuable addition to the office library. The price list is conveniently arranged under four distinct headings, and, as far as possible, the distances have been given which each type will take up on their respective shafts. Incidentally it is remarked that these clutches and gearing have been applied to some of the most difficult frictional drives, e.g., heavy calenders, mangles, beetles, gas, oil, and steam engines, water wheels, turbines, dynamos, haulage work, private work, etc., etc., which are bound to be started and stopped whilst running at full speed, the speeds varying from as low as three to over a thousand revolutions per minute. This is independent of shaft frictional couplings used for connecting and disconnecting the various rooms of cotton mills, works, etc., different sections of works, etc., at a moment's notice in case of accident or when working overtime.

CALLENDER'S
CABLE & CONSTRUCTION CO., Ltd
Telegrams: "CALLENDER, LONDON." Telephone: 1911 Holborn.

Head Office.
HAMILTON HOUSE,
VICTORIA
EMBANKMENT.

Works.
BELVEDERE,
KENT.

Laying Callender Mains for the Lancashire Electric Power Company.

Ice Making and Refrigerating Machinery.

CARBONIC
ANHYDRIDE (CO_2).

AMMONIA
COMPRESSION
and
LOW PRESSURE
ETHER SYSTEMS.

2,750 Machines Sold to Date.

Results Guaranteed.

Prompt Deliveries.

AWARDED SILVER
MEDAL, R.A. SHOW,
1904.

H. J. WEST & CO., Ltd.,
114—118, SOUTHWARK BRIDGE ROAD,
LONDON, S.E.

CABLES: "SAXOSUS."
TELEGRAMS: "COPPERWORM."
PHONE: 879 HOP.

Contractors to H. M. Government, War Department, and India Office.

PAGE'S WEEKLY Engines

John Fowler & Co. (Leeds) Ltd.

ENGINEERS

STEAM PLOUGH WORKS,
LEEDS.

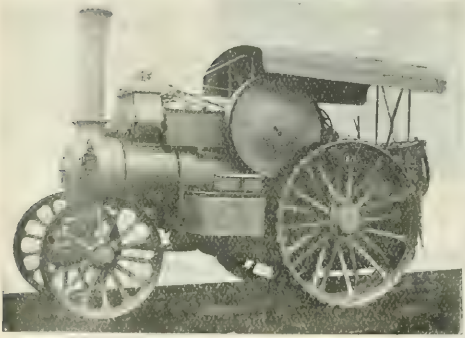
ENGLAND.

6, LOMBARD STREET,
LONDON, E.C.

Our works, founded in 1850, cover upwards of 14 acres, and employ about 2,500 men.

OVER 11,000 ENGINES MADE AND SUPPLIED.

The Largest Manufacturers in the World of



Traction Engines

FOR THRASHING, HAULING,
AND
FOR ALL FARM WORK.

ROAD LOCOMOTIVES,

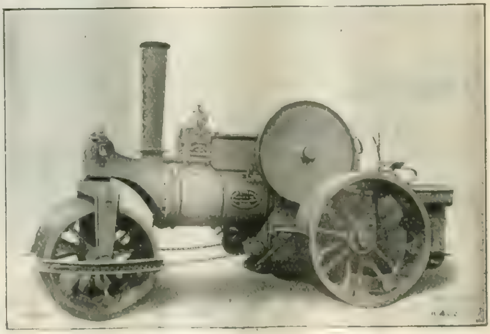
FOR
ALL KINDS OF TRANSPORT,
AND
SPECIALLY CONSTRUCTED
FOR
Heavy Haulage and Long Distances.

Fowler's Road Engines effect a saving of 40 per cent. to 60 per cent. over Animal Traction.

Steam Road Rollers and Road Scarifiers

The Best.
Most Efficient.
Most Economical.

Fowler's Road Rollers are so designed that they are easily converted into Traction Engines.



All above Engines can be used for Driving every Kind of Machinery by Belt.

REFERENCES TO USERS IN ALL PARTS OF THE WORLD.

PAGE'S WEEKLY Engines, &c.

McLAREN'S
Steam Ploughs
AND TRACTION ENGINES.

Catalogues and Pamphlets mailed free on application to—

J. & H. McLAREN, Midland Engine Works, **LEEDS.**

Cable Address: "**McLAREN, LEEDS.**

Codes used **A B C 4th and 5th Editions. LIEBERS**
Established 1876.

RAILS

FISHPLATES, BOLTS, SPIKES, CHAIRS &c.

POINTS AND CROSSINGS.

WILLIAM FIRTH LTD
LEEDS

THE HUNSLET ENGINE CO., LTD.
LEEDS.

MANUFACTURERS OF
TANK ENGINES
Of all Descriptions.

Designs and Specifications Supplied or Worked to.

Telegrams: "Engine, Leeds." Telephone: 52

BALDWIN LOCOMOTIVE WORKS.

Broad
and Narrow
Gauge

Locomotives

Single
Expansion
and Compound

Mine,
Furnace
and
Industrial
Locomotives.

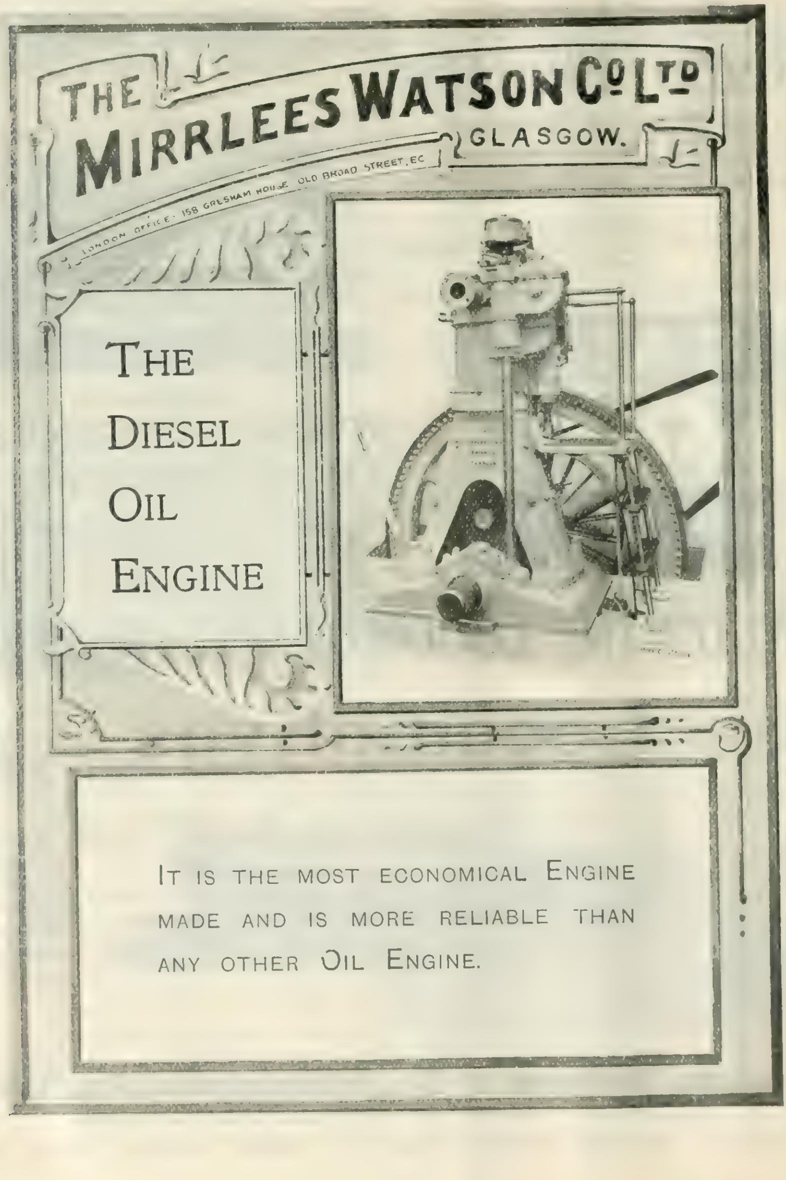
Electric
Locomotives
with
Westinghouse
Motors and
Electric Trucks

Burnham, Williams & Co., Philadelphia, Pa., U.S.A.

General Agents: SANDERS & CO., 110, Cannon Street, London, E.C.

Cable Addresses: "BALDWIN, PHILADELPHIA", "SANDERS, LONDON."

PAGE'S WEEKLY Oil Engines



THE MIRRLEES WATSON Co LTD
GLASGOW.
LONDON OFFICE: 158 GRESHAM HOUSE OLD BROAD STREET, E.C.

THE
DIESEL
OIL
ENGINE

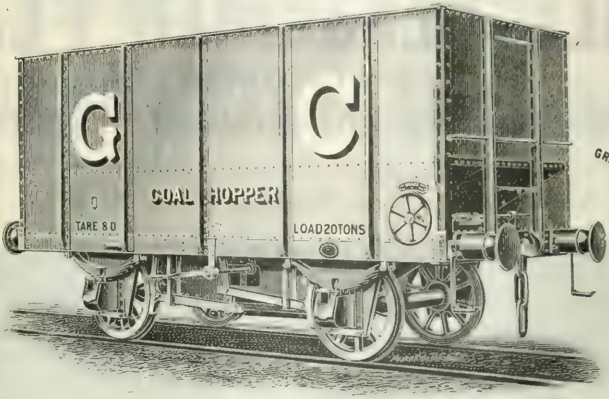
IT IS THE MOST ECONOMICAL ENGINE MADE AND IS MORE RELIABLE THAN ANY OTHER OIL ENGINE.

PAGE'S WEEKLY Rolling Stock, &c.

THE LEEDS FORGE Co., Ld.

BUILDERS OF PATENT ALL STEEL SELF-DISCHARGING 4-WHEELED & BOGIE WAGONS, 15 to 50 TONS AND UPWARDS CAPACITY AND EVERY DESCRIPTION OF PATENT PRESSED STEEL UNDERFRAMES AND BOGIES FOR RAILWAY ROLLING STOCK

ADVANTAGES OF PRESSED STEEL ROLLING STOCK:— LOWEST TARE, GREATEST CAPACITY AND STRENGTH, DURABILITY, INTERCHANGEABILTY OF PARTS, SMALL NUMBER OF PIECES.

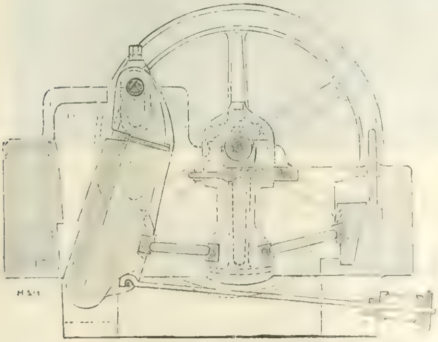


PATENT SELF-DISCHARGING WAGON 20 TONS CAPACITY.
Height from rails, 10 ft. Width Overall, 8 ft. Length over Buffers, 20 ft. 10 in.

LEEDS.

Agents: Messrs. TAITE and CARLTON, 63, Queen Victoria Street, LONDON, E.C.

STONE BREAKERS.
(Improved Blake Type.)



Section of Machine

Rollers,
Screens,
Gravel Washers,
Concrete Mixers.

SAMUEL PEGG & SON,
National Telephone 104
Alexander Street, LEICESTER, ENGLAND.

PAGE'S WEEKLY Bessemer Plant

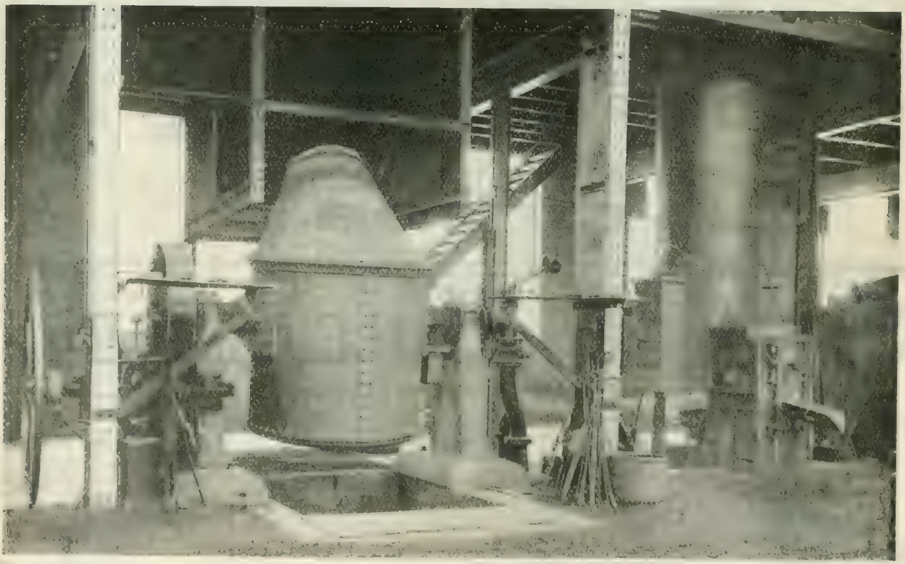
SMALL BESSEMER PLANT

(UNCKENBOLT SYSTEM)

For the Production of Steel and Iron Castings of Highest Qualities,

as in use at the

North German Lloyd Repairing Works, Bremen.



REFERENCES:

THE STETTIN VULCAN CO. STETTIN-BREDOW

THE [illegible] CO. LTD. BRUGES

THE WESER CO. LTD. BREMEN

NORTH GERMAN LLOYD REPAIRING SHOPS BREMEN

FREDERICK KRUPP, LIMITED, ESSEN.

Cost of Plant and License depends on the Particular Requirements of the Works.

For full Particulars and permission to see Plants in Operation, apply to

Paul J. Mallmann, M.A.,

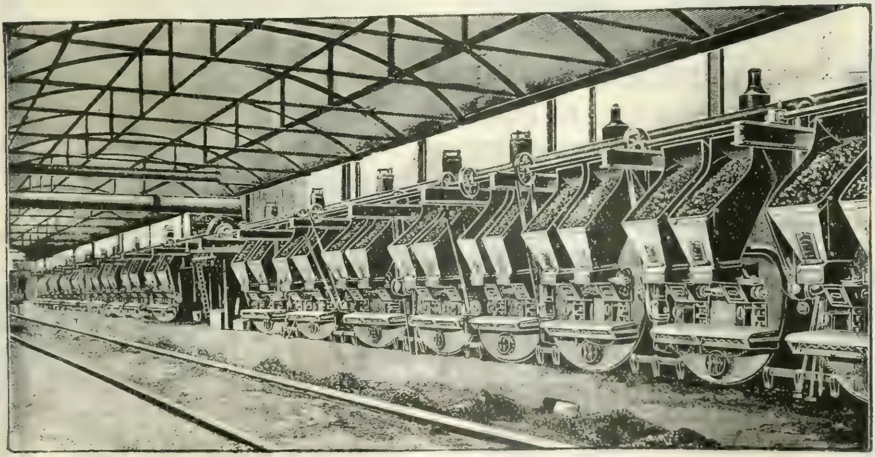
110-118, Victoria Street, LONDON, S.W.

BENNIS

STOKER & COMPRESSED AIR FURNACES

Suitable for either Lancashire, Cornish, or Water-tube Boilers.

THOUSANDS IN USE.



Photograph of Boilers which have been working night and day since 1899.

Write for descriptive Booklet—

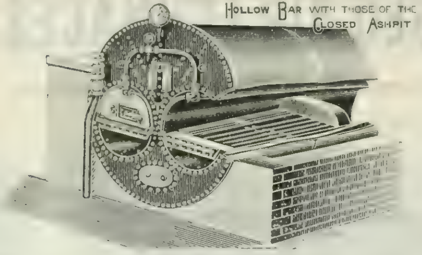
ED. BENNIS & CO., LTD.

Little Hulton Iron Works,

BOLTON.

FORCED DRAUGHT.

THE SECTIONAL FORCED DRAUGHT FURNACE
COMBINES ALL THE ADVANTAGES OF THE HOLLOW BAR WITH THOSE OF THE CLOSED ASHPIT



The Horsfall Destructor Co., Ltd.,
Armley, LEEDS.

Saving in Fuel,
Even Distribution of Air.
Fire not Blown into Holes.

CAN BE FITTED TO ANY BOILER.

Full Particulars on Application.

Telegrams: "Destructor, Leeds." Telephone: 2006 (Central) Leeds.
Codes: Lieber's Standard and A.B.C. (5th Edition).

COKE OVENS
AND THEIR HISTORY.

Price 1/6 Post Free. **Seventeen Whole Page Plates.**

CONTENTS.

Introduction
The Bee Hive Coke Oven
C. Otto & Company's Bee Hive Coke Oven of 1880
Key's Bee Hive Coke Oven 1903
Construction of the Modern Coke Ovens
The Simons-Carves Coke Oven
The Semet Solvay Coke Oven
Coppee's Coke Oven
Gustav Hilgenstock's Coke Oven
The Otto Hoffmann Coke Oven
The Otto Hilgenstock Coke Oven
Huessener's Coke Oven
Franz Brunck's Coke Oven
Koppers Coke Oven
Von Bauer's Coke Oven
Collin's Coke Oven
Poetter's Coke Oven
The By-Product Recovery Plant for Extracting Tar and Ammonia
The Products of the By Product Recovery Coke Oven
The Value of the By Products of Coke Ovens
List of the Principal Patents Granted from 1820 to 1903

BY

PAUL J. MALLMANN, M.A.,

Civil and Consulting Engineer and Coke Oven Expert,

110-118, Victoria Street, Westminster, London, S.W.

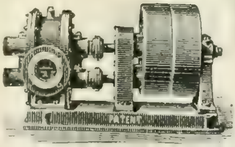
PAGE'S WEEKLY Boiler Mountings, &c.

WHEN ORDERING NEW BOILERS OR PIPE LINES
SPECIFY

WINN'S RELIABLE BOILER MOUNTINGS AND VALVES.

CHARLES WINN & CO. MAKERS BIRMINGHAM.

ENKE'S ROTATIVE PUMP



Best of all Systems for all Liquids.

4.000 Pumps under my System (with a capacity up to 15,000 litres per minute) in use.

ENKE'S PRECISION BLOWER.

Entirely of Iron without packing for high pressures to 0.3 atm.

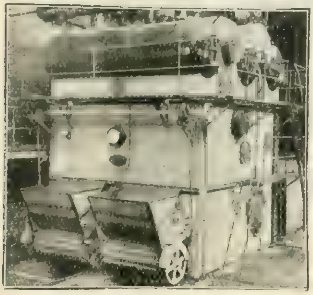
CARL ENKE, Schkeuditz-Leipzig, GERMANY.

Steam Boilers

(OF ALL TYPES AND POWERS).

Manufactured by

The GRANTHAM BOILER and CRANK CO., Ltd.,
GRANTHAM.



3,000,000 h.p.

STIRLING BOILERS
IN USE.

The Stirling Boiler Co., Ltd.,
Head Office and Works: MOTHERWELL, N.B.

London Office:
25, Victoria Street, WESTMINSTER, S.W.

MANUFACTURERS OF

Weldless Steel

and . . .

Iron

Tubes,

Steam Pipes, Hydraulic
Tubes, Boiler Tubes,
High Pressure . .
Steam Mains,

HOLLOW FORGINGS,
COLLARS, FERRULES,
BUSHES, LINERS,
COUPLINGS, AXLES,
PISTON RODS,
Etc., Etc.,
Quoted for on . .
receipt of . . .
particulars.

Tubes

. . FOR . .

Super-heaters

A SPECIALITY.

Contractors to the War Office and Admiralty.

TUBES LIMITED

BIRMINGHAM.

Nat. Telephone: No. 2582. Telegrams: "Cylinders, Birmingham."

PAGE'S WEEKLY Roofs

ROOFS

MAXIMUM of AREA covered at a MINIMUM of COST.

FOR
Shipbuilders,
Tanners,
Iron Founders,
Ropewalks,
Electricians,
Collieries,
&c., &c.

NEAT & STRONG.

Can be made up to 100 ft. span WITHOUT CENTRE SUPPORT.

Estimates given to any Plan and Specification.

McTEAR & CO., LTD.,
ROOF CONTRACTORS
Newtownards Road,
BELFAST, Ireland.
ON ADMIRALTY AND WAR OFFICE LISTS

Telegrams: "McTear Belfast"

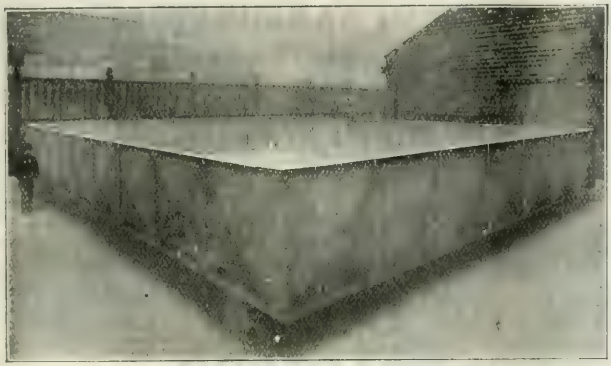
Telephone [illegible]

More durable than iron. Cheapest for all spans up to 100 Feet.

D. ANDERSON & SON, Ltd.,
LAGAN FELT WORKS,
BELFAST.

PAGE'S WEEKLY Tanks, Pumps, &c.

F. A. KEEP, JUXON & Co.



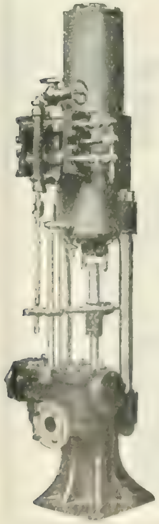
RIVETTED WORK
OF EVERY DESCRIPTION.

TANKS
FOR
ALL and EVERY PURPOSE.

MISCELLANEOUS IRON-PLATE and CONSTRUCTIONAL IRONWORK.

Forward Works,
BARN STREET,
BIRMINGHAM.

National Telephone 7[illegible]
Telegrams "Structures, Birmingham.



J. P. HALL & SON, Ltd.,
ENGINEERS,
PETERBOROUGH.

We make a SPECIAL Compound Direct Acting Slow Running

Boiler Feed Pump

ECONOMICAL AND EFFICIENT.

We deliver 100 lbs. of Water for the expenditure of 1 lb. of Steam. This with our 2,000 gallon Pump, and a much higher efficiency as the size of the Pump increases.

AN IDEAL PUMP FOR GENERAL BOILER FEEDING PURPOSES.

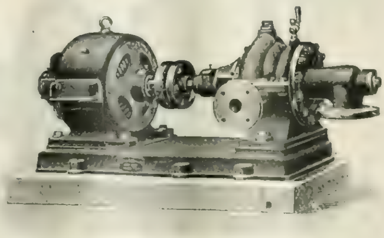
APPLY FOR PARTICULARS.

[illegible]
[illegible]

HIGH LIFT
Centrifugal Pumps

MOST SUITABLE AND MOST ECONOMICAL PUMPS FOR ALL ELECTRICAL AND INDUSTRIAL SERVICES

OUR SPECIALITY.



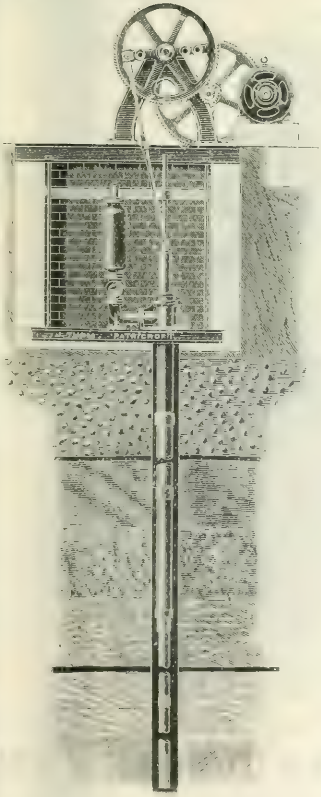
Made for any capacity for all lifts, with highest efficiency, specially for direct coupling with Electromotors, also high speed Electrical Plunger-Pumps for all services.

WEISE & MONSKI,
HALLE, O.S. (Germany).

BOREHOLE PUMPS

For Raising Water from Boreholes

A SPECIALITY.



BOREHOLE PUMP DRIVEN BY ELECTRIC MOTOR.

The one shown in the Illustration is a nice arrangement of a pump driven by Electric Motor through spur gearing, and is

VERY HANDY
and ECONOMICAL.

Estimates for

Boreholes & Pumps
SUBMITTED FREE

On application to

JOHN Z. THOM,
Patricroft,
near MANCHESTER.

PAGE'S WEEKLY Electrical Apparatus

"P.D.M." **PHŒNIX DYNAMO MANUFACTURING CO., LTD., BRADFORD**

LONDON OFFICE:—
17, Victoria Street, Westminster, S.W.
Telegraphic Address: "Phedyna, London."
Telephone: 1061 Victoria.

Telegraphic Address: "Dynamo, Bradford
Telephone: 952 Bradford.

DYNAMOS UP TO 750 K.W.

MOTORS UP TO 1,000 H.P.

FOR DIRECT AND ALTERNATING CURRENT.

WE HAVE AIMED AT AND HAVE ATTAINED

PERFECTION IN THE DESIGN OF OUR MACHINES

WHILST OUR PRICES ARE EXCEEDINGLY LOW. Write for Particulars.

Porcelain Manufacturer.
GUSTAV RICHTER
Charlottenburg, near BERLIN.
Write for one of our Illustrated Catalogues.

"WOODITE" WORKS, MITCHAM COMMON, SURREY.

NOTICE TO ENGINEERS, ELECTRICIANS, STEAM USERS, and OTHERS.—"WOODITE" articles can now be obtained with the utmost despatch. "WOODITE" has stood the severest test for six years. No material in existence can equal it for Steam or Electrical Purposes and other appliances. It has stood every test up to 40,000 volts for 1/8 in. sheet, without breaking down by the London Electric Light Corporation and others. [illegible] "U" Flat Joint and Packing Rings, Pump Cups, Gaskets, Manholes, Valves, Sheeting. Patent "WOODITE" G. G. Rings and all Mechanical and other Goods which have hitherto been manufactured in India Rubber, Leather, etc., can now be made of "WOODITE."

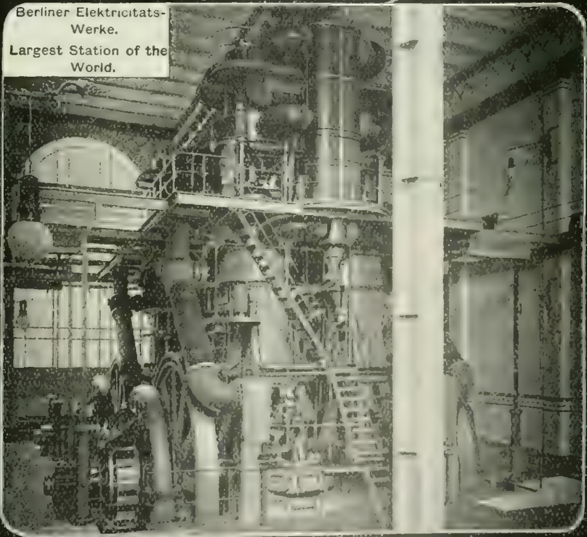
"WOODITE" COMPANY, MITCHAM, SURREY.

PAGE'S WEEKLY Electrical Apparatus

Allgemeine Elektricitäts-Gesellschaft, Berlin

Capital fully paid up: 60 000 000 Marks

Machine Works ◦ Electrical Apparatus-Works ◦ Cable Works
Incandescent-Lamp-Works



Berliner Elektricitats-Werke.
Largest Station of the World.

Continuous Current. Threephase Current.

Electric Lighting Plants. ◆ Electric Transmission of Power.
Electric Railways and Tramways. ◆ Electric Central-Stations.
Electrochemical Plants.

Agencies throughout the World.

Yearly Output 12000 Dynamos and Motors equivalent to 170 000 000 Watt
10 000 000 Incandescent Lamps. XI.

PAGE'S WEEKLY Electrical Apparatus

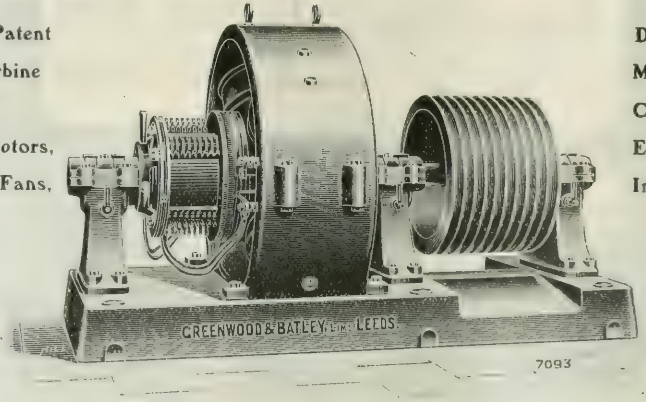
GREENWOOD & BATLEY, Ltd., ALBION WORKS, LEEDS.

MAKERS OF EVERY DESCRIPTION OF

ENGINEERS' GENERAL TOOLS and of SPECIAL TOOLS for War Material and a Great Variety of Purposes.

Representative in South Africa :—
W. G. TEBBUTT,
P.O Box 1471 Cape Town.

De Laval Patent
Steam Turbine
Dynamos,
Turbine Motors,
Pumps and Fans,



Dynamos and
Motors,
Complete
Electrical
Installations.

130 h.p. Motor, 500 volts, 470 revs.

Dynamos & Motors

Efficient.
Reliable.
Cheap.

Newton Bros., DERBY

AKTIENGESELLSCHAFT
Mix & Genest
Telephone and Telegraph Works
BERLIN, W.
INSTRUMENTS OF BEST AND APPROVED CONSTRUCTION.
Illustr. Catalogues supplied to the TRADE only

Telephone Apparatus
For Domestic Use, Town Lines, and Long Distance with Battery and Magneto Call.

Central and Multiple . . Switchboards.

Electric Bells, Indicators, Fire Alarms, Water Level Indicators.

ALL ACCESSORIES AND OTHER MATERIALS.

ELECTRIC CRANES

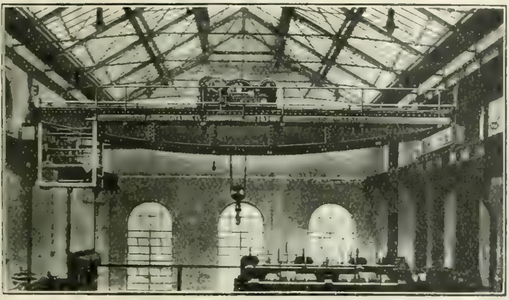
UP TO

100 TONS

CAPACITY.

SEND FOR OUR NEW CATALOGUE.

THOMAS BROADBENT & SONS,
LIMITED.
HUDDERSFIELD.



BRITISH
MAKE
THROUGHOUT

Electric Motors

THE "TURNER" OPEN TYPE.

Simple Mechanical Construction.

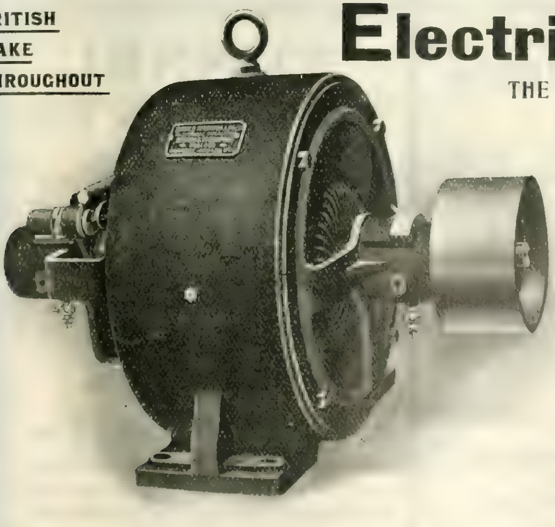
Low Temperature Rise.

Sparkless Commutation.

STANDARD SIZES—
½ h.p. to 40 h.p.

Further particulars on application

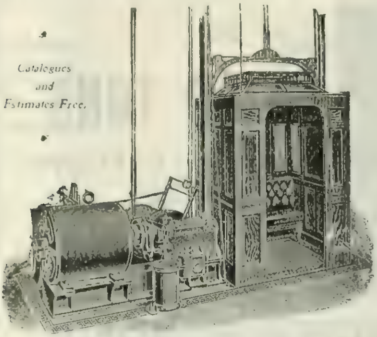
TURNER, ATHERTON, & CO., Ltd., DENTON, MANCHESTER.
ELECTRICAL ENGINEERS.



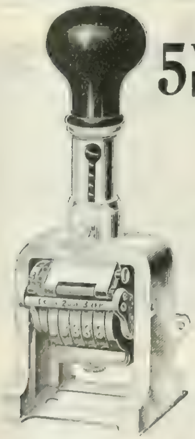
WAYGOOD
LIFTS.

By Special Appointment to H.M. the King.

Catalogues and Estimates Free.



Electric, Hydraulic, Belt Driven, Hand
LIFTS & CRANES.
FALMOUTH RD., LONDON, S.E.



SPECIAL!!!
5 WHEEL NUMBERING MACHINE
21/-
COMPLETE.
ONE SIZE FIGURE ONLY.
12345
STEEL WHEELS.
SELF-INKING
TRIPLE ACTION.
CHANGES AUTOMATICALLY.

HIGH CLASS MACHINES MADE WITH ANY SIZE FIGURE OR NUMBER OF WHEELS

Let us know your requirements.

THE RUBBER STAMP COMPANY,
Makers of Endorsing Stamps and Accessories.
Offices: 1 and 2, Holborn Chambers,
BIRMINGHAM.

INQUIRE
FOR
C. I. CHAIRS
AND
SLEEPERS
FROM
HEAD, WRIGHTSON & Co., LTD.

BRIDGE
CYLINDERS
FROM
HEAD, WRIGHTSON & Co., LTD.

WELL
CYLINDERS
FROM
HEAD, WRIGHTSON & Co., LTD.

TUNNEL
SEGMENTS
FROM
HEAD, WRIGHTSON & Co., LTD.

SHAFT
TUBBING
FROM
HEAD,
WRIGHTSON,
& Co., Ltd.,

TEESDALE IRON WORKS, THORNABY-ON-TEES;
STOCKTON FORGE WORKS, STOCKTON-ON-TEES;
EGGLESCLIFFE FOUNDRY, STOCKTON-ON-TEES

Steel Structures.

Chimneys.

BLAST FURNACE WORK.

RIVETED AND WELDED

Steel Pipes.

Tanks.

CAST IRON AND STEEL.

Patent Pressed Tanks from Stock.

CORRUGATED STEEL FURNACES.

FOX & MORISON. FOR MARINE AND LAND BOILERS FOR ALL SURVEYS.

Gas Works Plant.

Castings,

HIGH-CLASS LOAM WORK.

THOS. PIGGOTT & CO., Ltd.,

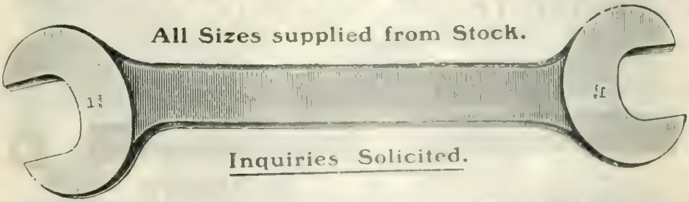
Telegrams: "ATLAS, B'HAM." BIRMINGHAM. Telephone: B'HAM. 86—4546.

ON ADMIRALTY, WAR OFFICE, AND INDIA OFFICE LISTS.

DROP FORGED STEEL

SPANNERS.

All Sizes supplied from Stock.



Inquiries Solicited.

THOMAS SMITH & SONS of SALTLEY, Ltd.,

Established 1848. SALTLEY MILL, BIRMINGHAM.

Farnley Iron

REFINERY.

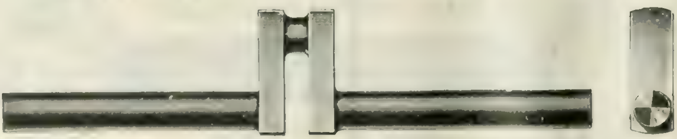
Farnley **Bar Iron** is used in **Mining** for pit cages, suspending gear, and other important parts, and on all the leading **Railways** in Great Britain, India, and the Colonies, for shackles and other vital parts subjected to repeated shocks.

Farnley Iron will stretch cold from **1⅛** in. to **2⅛** in. in a length of **6** in. before fracture, and is safest for **welding**.

Address: The Farnley Iron Co., Ltd., Leeds, England

ON ADMIRALTY LIST. Telegrams: "CRANKS, LINCOLN."

FOR CRANKS
& FORGINGS
OF EVERY
DESCRIPTION
WRITE TO



CLARKE'S
CRANK &
FORGE CO.,
LTD., LINCOLN,
ENGLAND.

PAGE'S WEEKLY Iron and Steel

HEAD OFFICE —
ST PAUL'S SQUARE,
BIRMINGHAM.

WATERLOO CHAMBERS
19, WATERLOO STREET,
GLASGOW.

BRAND THREE BOHLER

IMPROVED HIGH SPEED AIR-HARDENING STEEL

STAR BRAND

SAML. BUCKLEY

STYRIAN STEEL WORKS, SHEFFIELD

CORRESPONDENCE SOLICITED. PROMPT REPLIES PROMPT DELIVERIES

BRAND BOHLER

CHIEF ADVANTAGES

SIMPLE TO FORGE AND HARDEN.
HIGH SPEED AND DEEP CUTS.
INCREASED OUT-PUT WHEN TURNING CAST IRON AND MILD STEEL.

PAGE'S WEEKLY Iron and Steel

WALTER SCOTT, Ltd.,

LEEDS STEEL WORKS . . .

Telegrams "BESSEMER LEEDS"

LEEDS, ENGLAND.

Manufacturers of . .

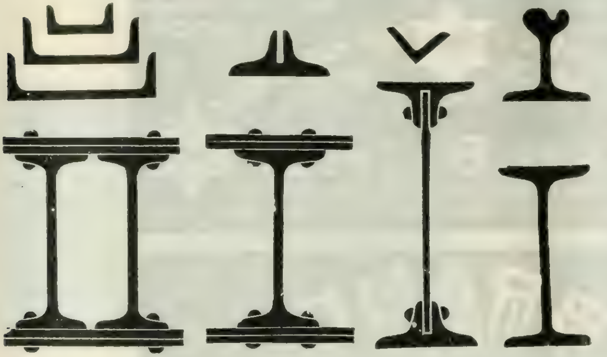
Rolled Steel Joists, Channels, etc.

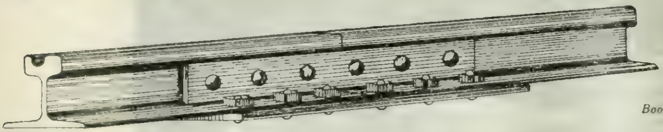
Mild Steel Blooms, Billets, Slabs, Tinbars. Rounds, and Flats.

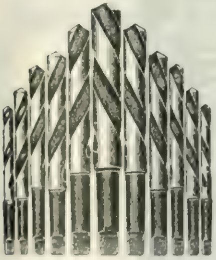
Speciality:

Tramrails

Books of Sections and other information on application.







Twist Drills,
Taps,
Milling Cutters,
Reamers.

H. F. SCHNICKE,
CHEMNITZ (Saxony).

Contractors to H.M. Government

BRADBURY & CO., LTD.

Capstan Lathes and Labour Saving Tools.

TRADE MARK
BRADBURY & COMPANY LIMITED
WELLINGTON WORKS OLDHAM

WELLINGTON WORKS, OLDHAM.

Lists Free.

STEEL CONSTRUCTION

IN ALL BRANCHES

Buildings Designed and Erected in all Parts of the World.

ROOF FRAMES, TRUSSES AND GIRDERS,
BLAST FURNACES AND STEEL WORKS, CUPOLAS, LADLES, CONVERTERS,
BOILERS, TANKS AND HEAVY PLATE WORK
HOLDERS, PURIFIERS, ETC.,
OPEN HEARTH FURNACE CASINGS
CHIMNEYS, RIVETED PIPE, CORRUGATED IRON

RITER-CONLEY MFG., CO., PITTSBURG, P.A., U.S.A.

New York Office: 39-41, Cortlandt Street.

RIVETS

ESTABLISHED 1817.

CONTRACTORS TO THE
Admiralty,
War Office,
India Office,
Etc.

BOLTS

Manufactured by . .

T. D. ROBINSON & CO., LTD.,
DERBY.

Telegrams: "Rivets, Derby."

Telephone No. 214

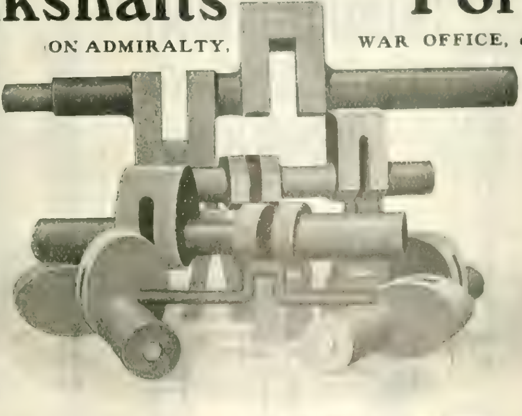
SCREWS

Crankshafts AND **Forgings**

(ON ADMIRALTY, WAR OFFICE, &c., LISTS.)

BENT CRANKS (Square or Round

FOR MARINE AND OTHER PURPOSES.



The above represents a Group of Crank Axles bent by hydraulic pressure, all throws bent in position. Welding being dispensed with

WOODHOUSE & RIXSON, Sheffield.

PAGE'S WEEKLY Iron and Steel

It "wont" interest you

much to learn that we were awarded highest prizes at St. Louis and other International Expositions for "Vulcan" Chain Pipe Wrenches, and "in truth" neither does it greatly elate us. We are encouraged more by the loyalty of buyers and users all over the world who began business with us fifteen to twenty years ago. That's our pleasure, and it increases constantly, too!

Stocked throughout Great Britain and Colonies.

J. H. WILLIAMS & CO.
Superior Stampings only.
BROOKLYN, N.Y.

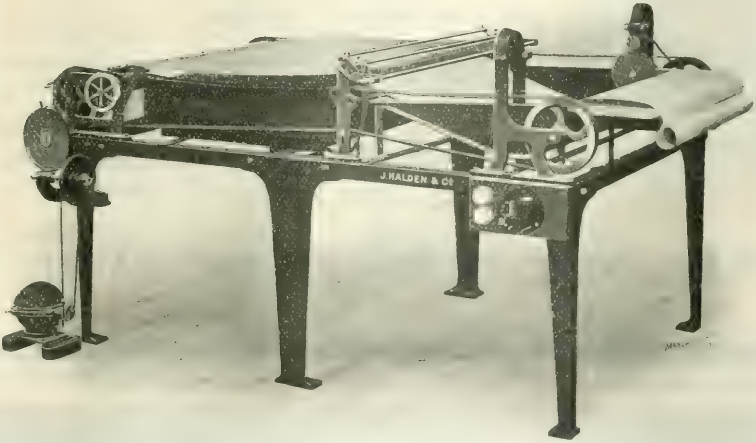
HERBERT W PERIAM LTD.
FLOODGATE ST WORKS
BIRMINGHAM.

TELEGRAPHIC ADDRESS
"FLOODGATE" BIRMINGHAM.

TELEPHONE No. 373.

STOCK 250,000 GROSS

MODERN
ENGINEERING PHOTOGRAPHY.



J. HALDEN & CO.'S

Photo-Print Developer and Dryer.

The Latest Production for Facilitating Photo-Copying and Promoting Cleanliness.

INSPECTION INVITED.

Washes and Dries Photo-Prints of any length.

Write for Particulars and Quotations.

J. HALDEN & CO., 8, Albert Square,
LONDON, NEWCASTLE-ON-TYNE,
BIRMINGHAM, GLASGOW, & JOHANNESBURG.
MANCHESTER.

DON'T HESITATE,

BUT INSTRUCT YOUR STATIONER TO SUPPLY

"BEDFORD BOND"

Every Sheet bears this Watermark, ☞

Manufactured in White and Five Tints.
Specially adapted for Departmental Stationery.

SUPERFINE TYPEWRITING PAPER.

Is the money rolling in?

Are you running your works as an Expensive Hobby?

BUSINESS SYSTEM & ORGANISATION

will often serve to convert a wobbling concern into a sound commercial property. **If in need of Expert advice, write –**

"Business Engineer," c/o "PAGE'S WEEKLY,"
CLUN HOUSE, Surrey St., LONDON, W.C.

PAGE'S WEEKLY Engineers' Appliances

LABOR SAVING OFFICE DEVICES

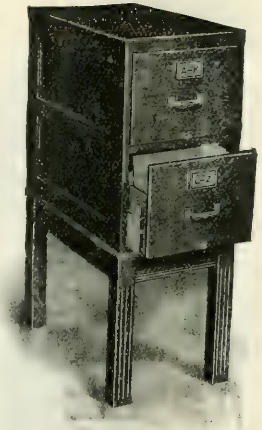
Trade Mark.

SPECIAL OFFER!

A Filing Cabinet

which holds 10,000 letters for

£5 10s.



This offer consists of a complete Vertical Filing Outfit, solid Quartered Oak, as illustrated.

The Outfit consists of a Two-Drawer Vertical Filing Cabinet, with Stand fitted with 200 Manilla Folders, and 40 Numerical or Alphabetical Guides.

A LIMITED NUMBER ONLY WILL BE SOLD AT THIS PRICE.

Refer to this Magazine in ordering.

Joinery and Cabinet Works: DALSTON, LONDON, N.E.

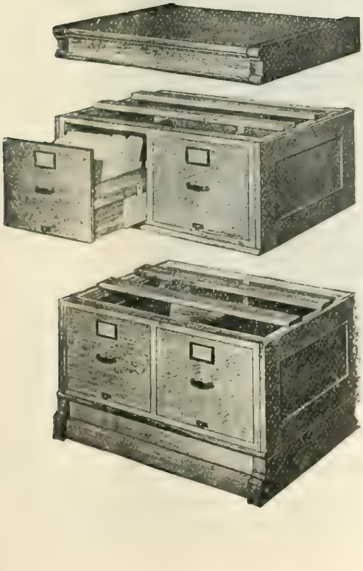
The Shannon, Ltd.,

Head Offices and Showrooms: Ropemaker Street, LONDON, E.C.

Telephone 1900 London Wall

F. W. SCHAFER, Managing Director.

"PETIT A PETIT L'OISEAU FAIT SONT NID."



The

Lyle Dossier Filing System

Follows the above maxim.

THE LYLE COMPANY, Ltd.,

Harrison Street,

GRAY'S INN ROAD,

LONDON, W.C.

TIME RECORDERS
of all kinds
FOR ALL TRADES

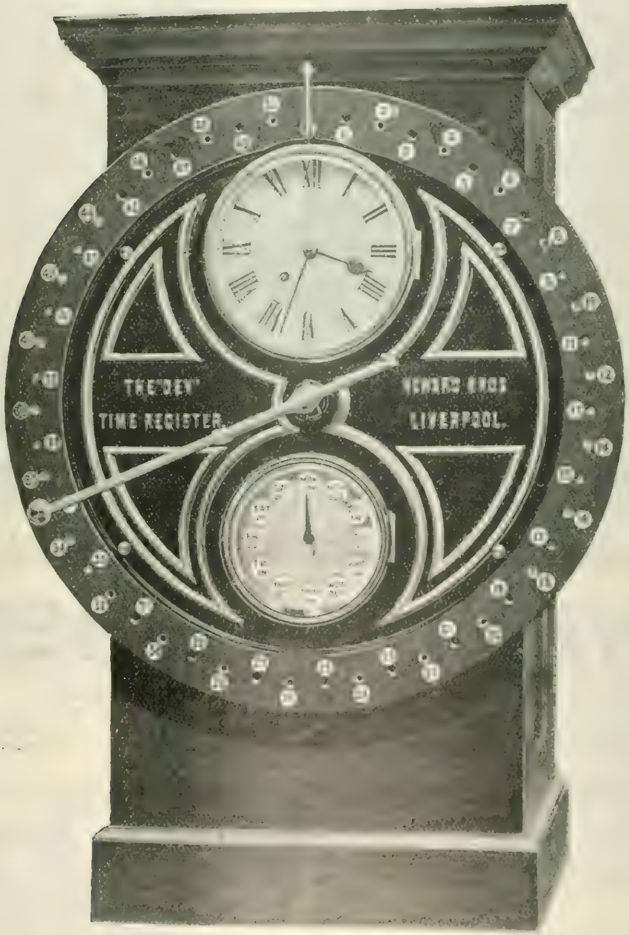
RECORDERS LIMITED
171 QUEEN VICTORIA ST
LONDON E.C.

ALL our Time Recorders are made to STANDARD GAUGES, spare parts being kept in stock, enabling any repairs to be executed on the premises WITHOUT DELAY.

PAGE'S WEEKLY Time Recorders

Indispensable to Employers of Labour.

TIME
KEEPING
BY
WEEKLY
TIME
SHEETS.



COST
KEEPING
BY
CARDS.
ON SAME
MACHINE.

THE "DEY" TIME REGISTER.

HOWARD BROS., Proprietors and Manufacturers,
100b, Queen Victoria Street, LONDON. E.C.
Head Office **40, Paradise Street, LIVERPOOL.**

PAGE'S WEEKLY Railways

NORTHERN RAILWAY OF FRANCE
AND
SOUTH EASTERN & CHATHAM RAILWAYS.

FREQUENT and RAPID COMMUNICATION BETWEEN LONDON and PARIS.

SHORTEST SEA PASSAGE
(ONLY ABOUT SIXTY MINUTES).

FIVE QUICK SERVICES DAILY, as under:—

Via DOVER AND CALAIS.

Depart. from London			Arrival in Paris.
†*	9.0 a.m. (Charing Cross Station)	For PARIS only	4.45 p.m.
		For Intermediate Stations	6.5 p.m.
†	11.0 a.m. from	Victoria Station	6.45 p.m.
‡	9.0 p.m. "	Charing Cross Station	5.50 a.m.

Depart. from Paris.			Arrival in London	
†	8.25 a.m.	For Intermediate Stations	4.55 p.m.	Charing Cross Station.
†*	9.50 a.m.	For CALAIS only ...		
†*	12 noon	...	7.5 p.m.	Victoria Station
‡	8.40 p.m.	... Intermediate Stations	5.40 a.m.	Charing Cross Station.

Via FOLKESTONE AND BOULOGNE.

Depart. from London,			Arrival in Paris.
‡	10.0 a.m.	from Charing Cross Station ...	6.5 p.m.
†*	2.20 p.m.		9.15 p.m.
‡	2.20 p.m.		11.25 p.m.

Depart. from Paris.			Arrival in London.	
‡	8.25 a.m.	Intermediate Stations ...	3.45 p.m.	Charing Cross Station
‡	2.40 p.m.			
†*	4.0 p.m.	For Boulogne only ...	10.45 p.m.	

† 1st and 2nd Class only. ‡ 1st, 2nd, and 3rd Class. * Restaurant Car between Paris and Calais or Boulogne, and *vice versâ*.

⁂ First-class Hotel and Restaurant at the Gare du Nord, Paris, and at Calais Maritime Station. Luncheon Baskets obtained at fixed prices.

The 2.20 p.m. departure from Charing Cross is the fastest connection between London and Bâle for Switzerland and Italy, *viâ* the Gothard Route. Through Corridor Trains and Restaurant and Sleeping Cars.

South Eastern & Chatham Railway.

THE CONTINENT

Four Royal Mail Routes

VIA

DOVER CALAIS.	FOLKESTONE BOULOGNE.	DOVER OSTEND.	QUEENBORO FLUSHING.

LONDON-PARIS IN LESS THAN SEVEN HOURS.

Five Services Daily in Each Direction.

NEW EXPRESS AFTERNOON DINING CAR SERVICE.

Daily (Sundays included), *via* FOLKESTONE and BOULOGNE.

	P.M.		P.M.
CHARING CROSS - - - - - - - - -	2.20	PARIS - - - - - - - - - - - - -	4.0
PARIS - - - - - - - - - - - - -	9.15	CHARING CROSS - - - - - - - -	10.45

Mail Route *via* Dover and Ostend.

Three Express Services Daily in Each Direction.

Flushing Royal Mail Route to Germany, etc.

Two Services Daily in Each Direction.

For Full Particulars see S.E. & C.R. Continental Time Tables, price 3d.

VINCENT W. HILL, *General Manager.*

Arthur Stafford & Co.

Read what the "Caxton Magazine" the Official Organ of the Printing and Kindred Trades, says about our Printing.

"An illustrated Catalogue printed by MESSRS ARTHUR STAFFORD & CO., Denton, is a decidedly up-to-date specimen of typography and half-tone printing, and reflects the highest credit on the producers."

"An extremely tasteful piece of work, perfectly produced."

HIGH GRADE PRINTERS

of Engineers' Catalogues, &c., at the Best Prices.

Modern Printing for Modern People.

Central Printing Works, DENTON,
MANCHESTER.

JOHN SWAIN & SON LTD

Specialists in the production of
HIGH CLASS ILLUSTRATED CATALOGUES
ADVERTISEMENTS SHOW CARDS etc

SEE OUR SPECIMENS IN
"HALF TONE"
"THREE COLOUR"
"WOOD ENGRAVING"
"LINE" &c.

58 Farringdon St.
LONDON E.C.

Telegrams: "ISOCHROMATIC LONDON." Telephones:—NATIONAL, 796 HOLBORN. POST OFFICE, 1909 CENTRAL.

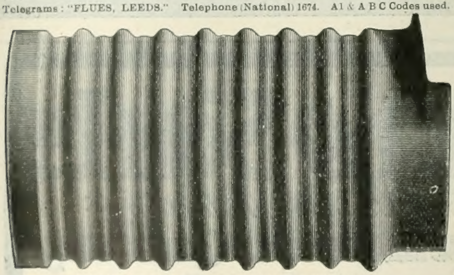
PAGE'S WEEKLY Miscellaneous

TEON THE BEST BELT FOR EXPOSED SITUATIONS.

CONTRACTORS TO H.M. GOVERNMENT, FOREIGN GOVERNMENTS HOME & FOREIGN RAILWAYS.
INCORPORATING FIRMS ESTABLISHED OVER 100 YEARS.
FLEMING, BIRKBY & GOODALL, LTD.
HEAD WORKS & REGISTERED OFFICES,
West Grove Mill, HALIFAX.
STANDARD OAK-TANNED LEATHER BELTING.
13 INTERNATIONAL EXHIBITION AWARDS.
GILBERT WOOD SPLIT PULLEYS. PRINCIPAL AGENTS LARGE STOCK HELD.
SOLE MAKERS OF "TEON" BELTING the Premier Heat, Steam, Water & Acid Proof Belt.
HYDRAULIC LEATHERS and all kinds of MILL & MECHANICAL LEATHERS.
SEWN AND SOLID WOVEN COTTON BELTING.
"SUPERIOR" HAIR BELTING.
TELEGRAPHIC ADDRESS: "FLEMING, HALIFAX."
TELEPHONE No. 48 HALIFAX.

BELTING NOT AFFECTED BY STEAM, HEAT, OR COLD.

Telegrams: "FLUES, LEEDS." Telephone (National) 1674. A1 & A B C Codes used.


ASHLIN 1897 PATENT WITHDRAWABLE FURNACE

Deighton's Patent Flue & Tube Company, Ltd.

DEIGHTON'S FURNACE.

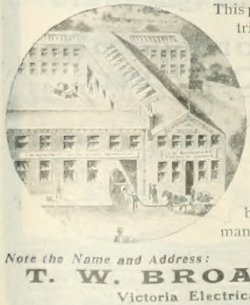
The Destructive Tests have proved the DEIGHTON FURNACE to be the strongest to resist collapse ever made.

It is also unequalled for Uniformity of Thickness and Easy Scaling.

MAKERS OF MARINE and LAND BOILER FURNACES.

Awarded 2 Bronze Medals, Paris Exhibition, 1900.

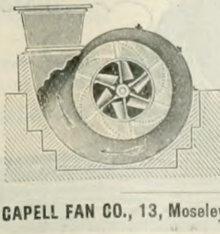
**Vulcan Works,
Pepper Road, LEEDS.**


This picture represents an Electrical Engineering Works in Yorkshire, which is specially laid out for the manufacture of Dynamos, Motors, Switches, and Switch boards. Everything is of the best; and prices are the lowest possible, consistent with best material and workmanship.

Note the Name and Address:
T. W. BROADBENT,
Victoria Electrical Works,
EAST PARADE, HUDDERSFIELD.

The CAPELL Patent Mine Fan

IN USE ON MINES ALL OVER THE WORLD.


Furnace Gas Cleaning Fans
(In large use).

Induced & Forced Draught Fans.

Fans for Ventilation of Buildings.

ADVANTAGES:—
Highest Economy in Power
Small Size of Fans.

CAPELL FAN CO., 13, Moseley St., NEWCASTLE-ON-TYNE.

GREEN'S ECONOMISER

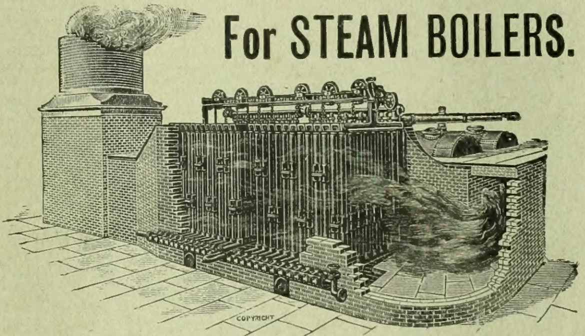
SAVES 15 TO 25 PER CENT. IN COAL

For STEAM BOILERS.

MAKES
EASY
WORKING
IN THE BOILER HOUSE.

More Steam and higher efficiency at less cost. Large reserve of feed water at evaporative point always ready on sudden demand for extra power.

Catalogue gives details.

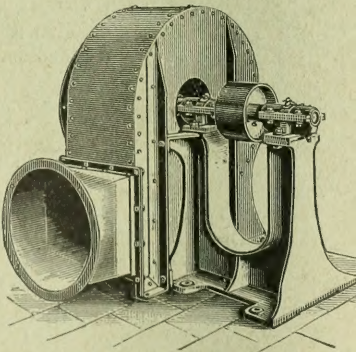


E. GREEN & SON, Ltd., WAKEFIELD, MANCHESTER, LONDON, AND GLASGOW.

BUILDINGS should be HEATED and VENTILATED with PURE AIR.

"SIROCCO" FANS,
"SIROCCO" AIR HEATERS,
AND
"SIROCCO" AIR COOLING AND FILTERING APPARATUS.

Highest Award, Grand Prize, St. Louis Exposition, 1904.



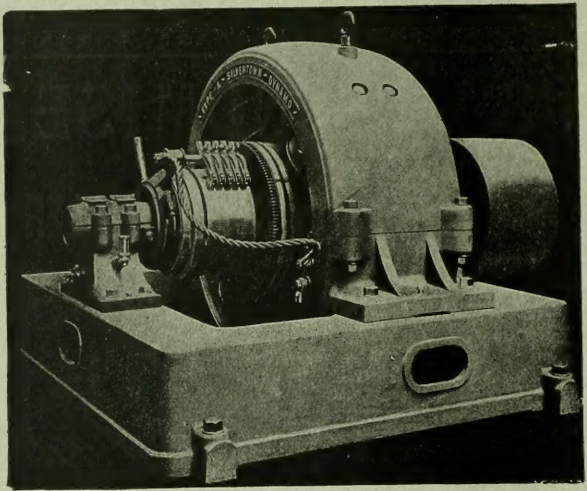
DAVIDSON & CO., LTD. "SIROCCO" ENGINEERING WORKS, BELFAST.

13, Victoria Street, Westminster,
LONDON.

37, Corporation Street,
MANCHESTER.

115, Hope Street,
GLASGOW.

Sole Representatives for the Continent of Europe:—
WHITE, CHILD, & BENEY, Ltd., 62 and 63, Queen Street, LONDON, E.C.



Offices :
106, Cannon St.,
LONDON, E.C.

Works :
SILVERTOWN,
LONDON, E.

The India Rubber, Gutta Percha, & Telegraph Works Co., Ltd.

CONTRACTORS TO HIS MAJESTY'S AND OTHER GOVERNMENTS.

JAMES FAIRLEY & SONS,

General Steel Manufacturers, and SPECIALISTS in . . . **TOOL STEELS**

Invite attention to their Unrivalled Self-hardening Steel.

FAIRLEY'S SELF-HARDENING TOOL STEEL

FOR HEAVY CUTS AT HIGH SPEEDS.

Is considered to be the HARDEST and TOUGHEST Steel yet made (although the cheapest in the Market). Small samples free to approved buyers.

NOTE.—JAMES FAIRLEY & SONS' WORKS (Bramall Lane, Sheffield, and Mill Street Forge and Rolling Mills, Birmingham) are merely Branch Departments, and

All Communications should be addressed to the Head Offices :—

OLD MINT, SHADWELL STREET, BIRMINGHAM.

PLAN-COPYING PAPERS and LINENS,
and LINEN-BACKED PAPERS, giving Blue, Black, and Brown Lines on White Ground, or *vice versa.*

THE FINEST QUALITY ON THE MARKET. FOR ENGINEERS AND ARCHITECTS.

Descriptive Booklet, Specimen Prints, and Price List post free on application.

MARION & Co., Ltd., 22 & 23, Soho Square, London, W.

Printed for the Proprietors by SOUTHWOOD, SMITH & CO., LIMITED, 6, 7, 8, 9, Plough Court, Fetter Lane, London, E.C.; and Published at Club House, Surrey Street, Strand, London, W.C.